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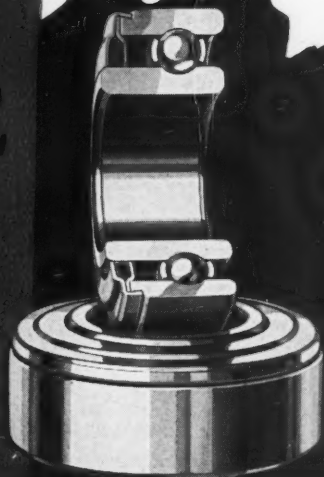
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# Machine Shop

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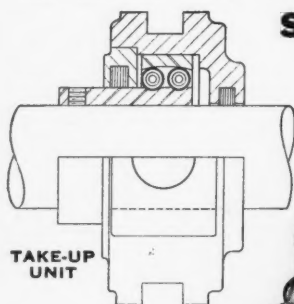
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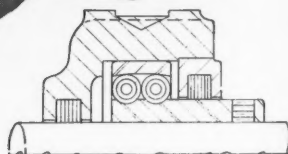
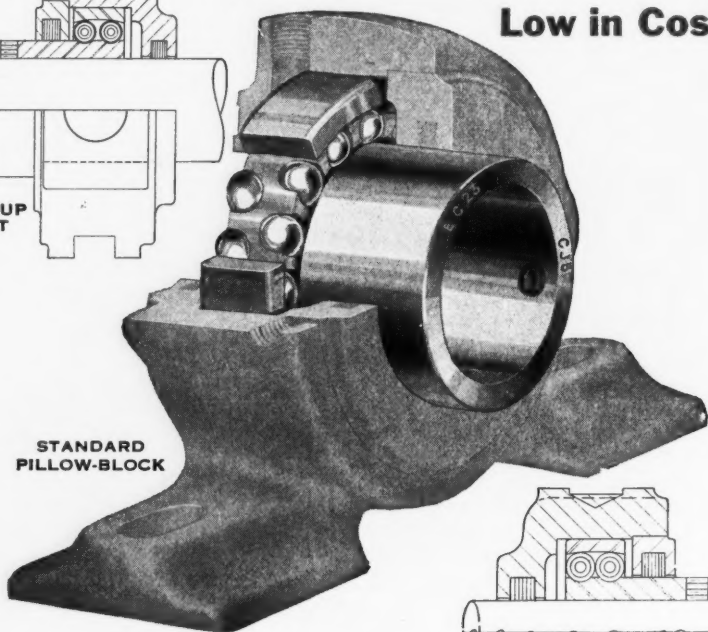
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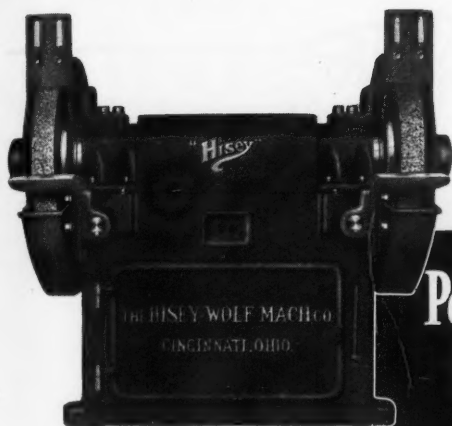
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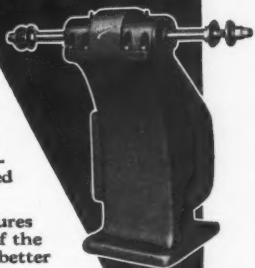
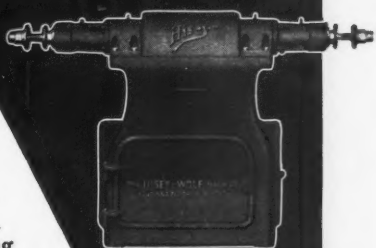
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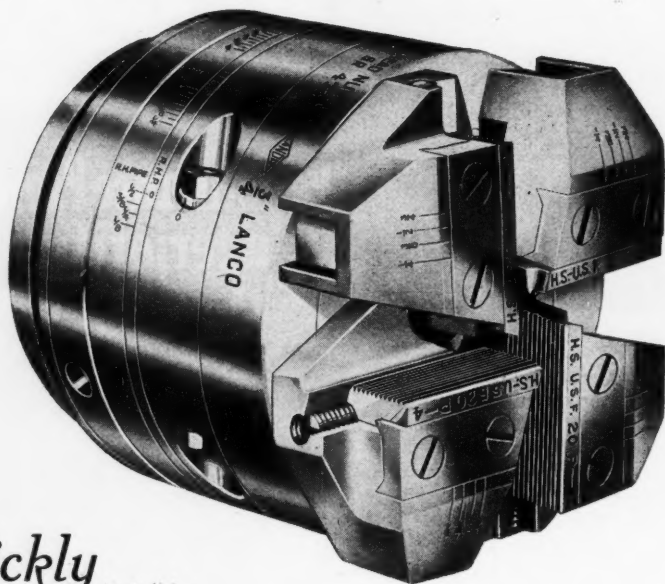
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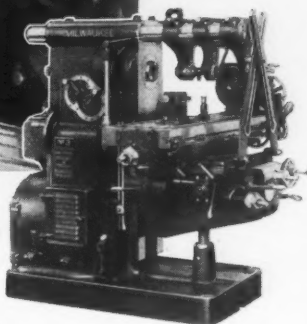


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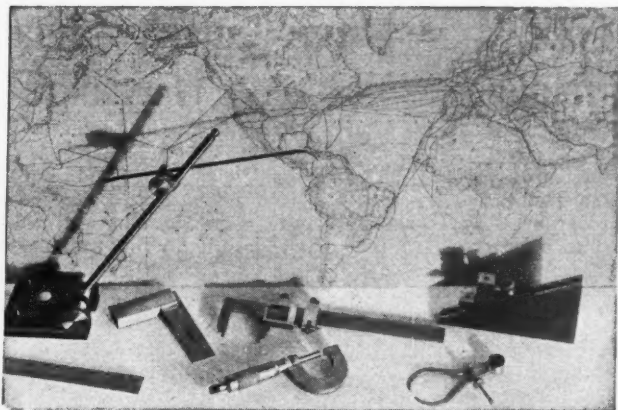
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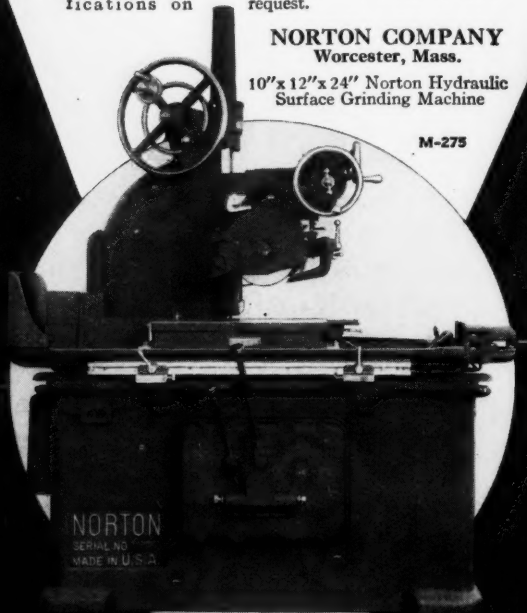
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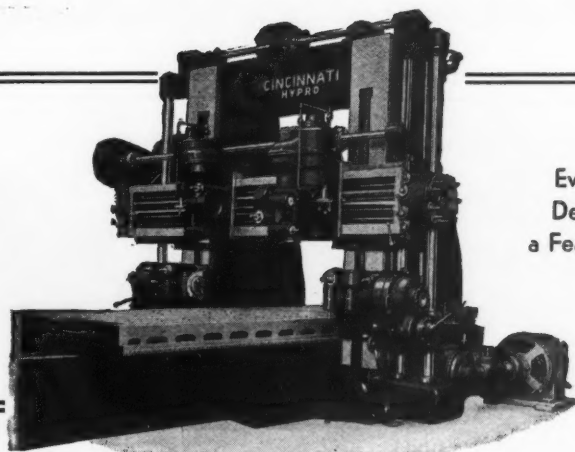
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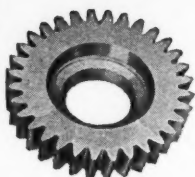
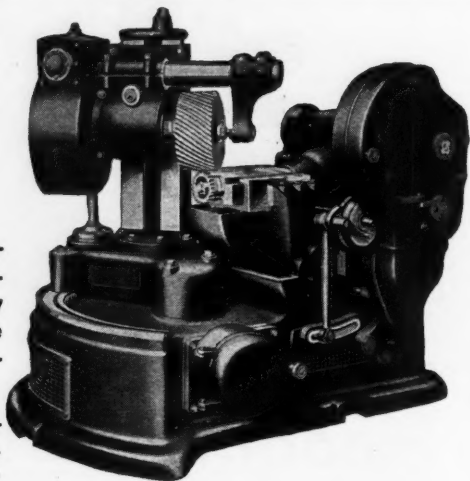
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# MODERN Machine Shop

*A Magazine for Machine Shop Executives*

HOWARD CAMPBELL, Editor

Vol. 3

APRIL, 1931

No. 11

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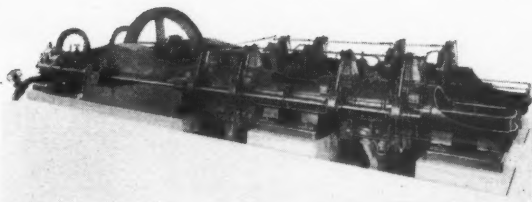
CINCINNATI, OHIO

VOL. 3, No. 11

## Building Cooper-Bessemer 760 H.P. Gas-Engines

*In this article the writer tells how the parts that go into these big power units are machined.*

By HOWARD CAMPBELL



WHEN Charles and Elias Cooper built their first iron melting cupola at Mt. Vernon, Ohio, in 1833, they founded an industry which has since become one of the world's leaders in the manufacture of power machinery. The first Cooper blowing engines were built in 1852; as the modern gas engine and air and gas compressors were developed, they were also added to the Cooper line of products. At the present time this

firm is building pumping and drilling engines, general commercial power engines, air and gas compressors, Diesel oil and gas engines up to 760 h.p., and other similar units. To the person who is accustomed to small work, the methods and tools used in the machining of the parts for these large power units should be of unusual interest.

The operation shown in Fig. 1 is that of boring and facing the opening in the end of the engine bed so that the cylinder can be assembled to it. The bed is set up on a large horizontal mill, and the tool is clamped in a tool block on a radial facing arm, where it is fed across the face of the casting by a star wheel on the end of the arm. When boring, the entire bar is fed longitudinally, carrying the arm

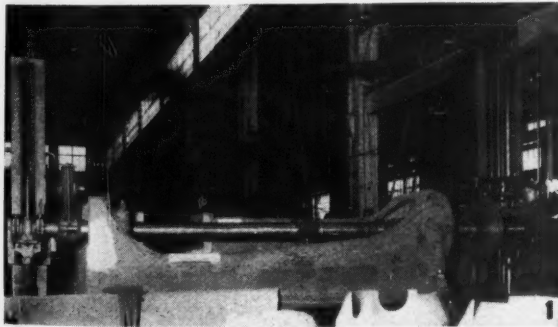


Fig. 1—Boring and facing engine bed for 760 h.p. gas engine.

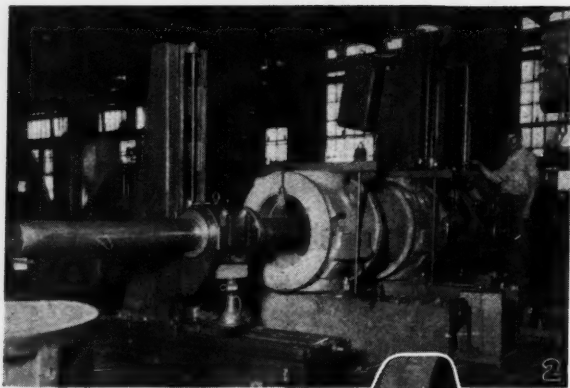
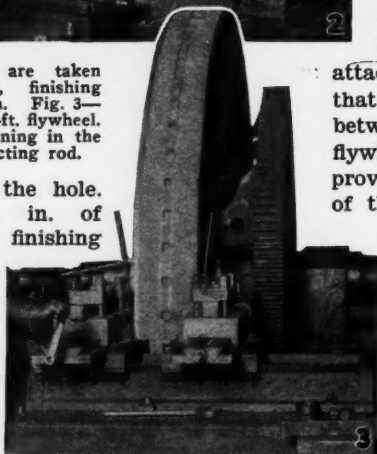


Fig. 2—Three cuts are taken through the cylinder, finishing within a limit of 0.005 in. Fig. 3—Turning and facing a 14-ft. flywheel. Fig. 4—Milling the opening in the large end of a connecting rod.

and tool through the hole. Approximately  $\frac{3}{4}$  in. of stock is removed, finishing the hole to 28 in. diameter.

The operation of boring the cylinder is shown in process in Fig. 2. Approximately  $\frac{5}{8}$  in. of stock is removed from the bore, which is taken out in three cuts. In the first cut all but  $\frac{1}{16}$  in. of stock is removed, in the second cut the stock is reduced to 0.010 in., and in the third cut the bore is finished to within 0.005 in. of drawing size. The cylinder is machined complete in 12 hours.

Figure 3 shows the operation of turning and facing a flywheel for one of the large engines. The hub having



been bored in a previous operation, the wheel is located on a special arbor. This arbor is designed for various sizes of rings, to fit the different bores of various sizes of fly wheels. This method seems rather crude, but assures that the faces of the flywheel will run true. The flywheel is driven by means of a large gear to which are

attached three brackets that project so as to slip between the spokes of the flywheel. Two tool slides provide for facing both sides of the flywheel simultane-

ously. Approximately  $\frac{1}{4}$  in. of stock is removed from each side and  $\frac{1}{2}$  in. from the periphery. The time required, floor to floor, is 16 hours.

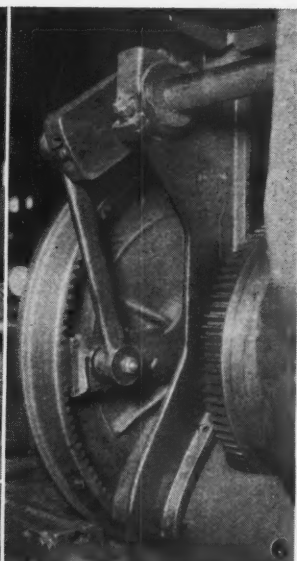
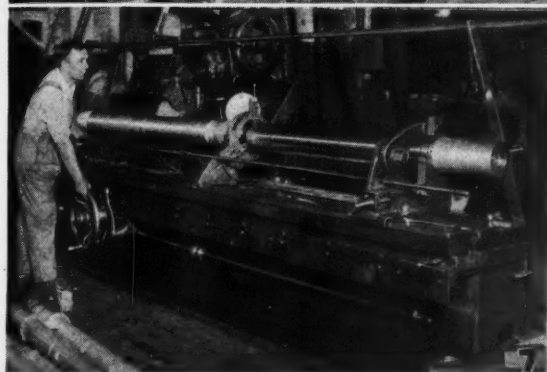
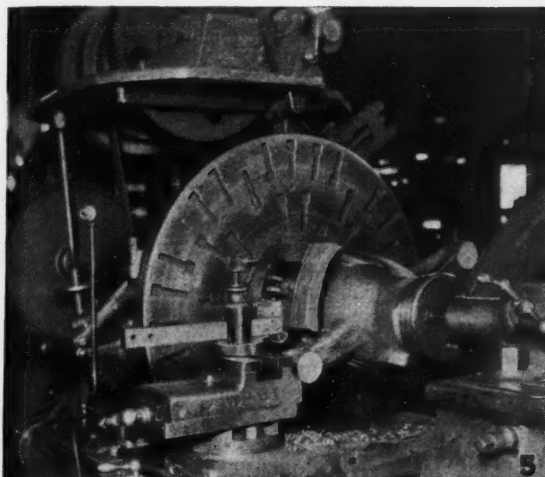


Fig. 5—Performing a radial shaping operation on an engine lathe. Fig. 6—The reciprocating motion of the faceplate is obtained by linking the faceplate to a crank arm. Fig. 7—The piston rods for the big engines are ground to size in this Landis 10-ft. cylindrical grinder.

takes two hours. A small amount of stock is left for the finishing operation, which is completed in  $1\frac{1}{2}$  hours.

The opening in the large end of the connecting rod is milled out by setting the rod up on a milling machine as shown in Fig. 4. This opening is rectangular,  $12 \times 17\frac{1}{2}$  in. The rod is laid out to give the milling machine operators a line to work to, and a hole is drilled through which a  $1\frac{1}{2}$ -in. spiral milling cutter can be inserted. The rod is then set up on the milling machine table, as shown, the cutter is slipped into the hole and locked into the spindle, and a cut is taken following the layout line, thus cutting out a solid block of stock. This operation

In Fig. 5 is shown an operation in which an engine lathe is used to perform a radial shaping operation. The piece is a cross-head, on which the shoes are to be finished on a radius. The shoes could be turned, except for the fact that there are two arms on the casting which make it impossible to rotate the piece between the lathe centers. It can, however, be rotated far enough to take a cut across one shoe at a time. Accordingly, a method was devised whereby the piece is rotated far enough for a cut to be taken, then the piece is reversed to the start-

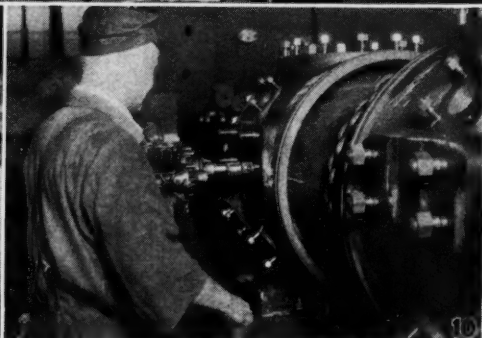
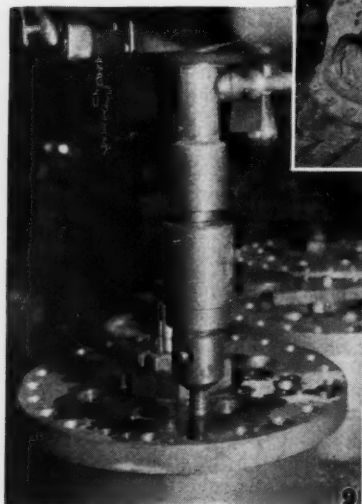
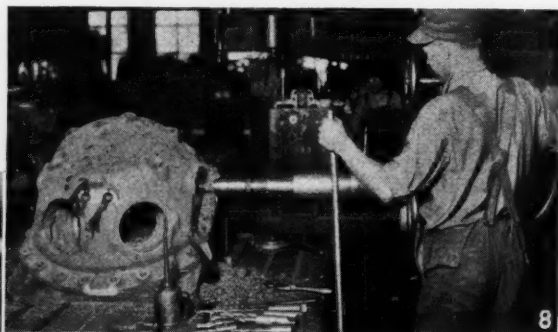
ing point and the operation is repeated.

The crosshead is firmly bolted to the faceplate so that it cannot swing on the reverse movement, and the opposite end is supported by the tailstock center, which is inserted into a center hole in a plug that has been screwed into the neck of the piece. The reciprocating movement of the faceplate is obtained through the use of a crank arm, the shaft of which is geared to the motor. The crank arm, Fig. 6, carries one end of a connecting link, the opposite end of which is anchored to the rear of the faceplate so that, as the arm is revolved with the shaft, the link is reciprocated vertically, revolving the faceplate first in one direction and then in the other. The amount of movement of the faceplate can be regulated by adjusting the link

on the crank arm. When the shaping operation is completed, the intermediate gear is swung out of mesh with the motor, the connecting link is released from the faceplate, and the back gears are thrown into mesh so that the lathe is again ready to turn cylindrical work. The neck of the piece is bored to 8.135 in., threaded 8% P. with a single point tool, the arms are faced, and the shoes are shaped in approximately 20 hours.

The piston rod for the big engine is 12 ft. 9 $\frac{1}{8}$  in. long, and is 6.250 in. diameter when finished. After being rough turned in the lathe, in which operation 0.020 in. of stock is left for finishing, the rod is ground to size in the Landis 10-ft. cylindrical grinder shown in operation in Fig. 7. As the rod is too long to be swung between centers, one end is chucked and the other end is left to revolve free in a

Fig. 8—Tapping  $\frac{5}{8}$ -in. holes in a cylinder head, using an Apex friction chuck. Fig. 9—Equipment with which  $\frac{1}{4}$ -in. studs are set in cylinder heads. This Apex type "K" chuck permits top speed and prevents breakage. Fig. 10—Assembling the camshaft bracket to the cylinder.





# A NEW STORY

## about an Old Name

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Practical shop men from coast to coast, who do their own thinking, investigating and selecting, have bought Covel Grinders—and stick to Covels. We can tell you why!

**COVEL MANUFACTURING CO.**  
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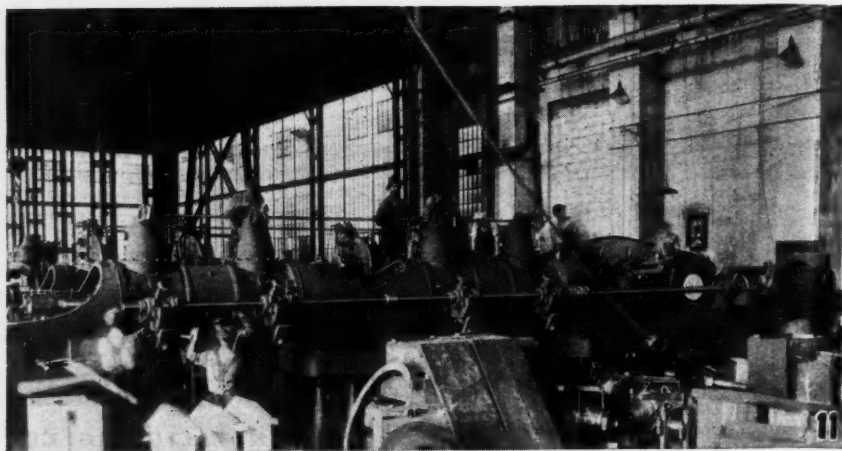


Fig. 11—Here the engines are assembled before shipment.

steady rest. When one end of the rod is finished, the rod is reversed and the opposite end is ground. The grinding operation is completed in three hours.

The stud holes around the ports in the cylinder heads are tapped with the horizontal drill shown in operation in Fig. 8. For this operation a  $\frac{5}{8}$ -in. tap is used, driven by an Apex quick-change friction tapping chuck. The chuck contains a series of multiple discs of fiber and steel, alternately, and is so constructed that it can be adjusted to withstand any pressure desired. When once adjusted, one of these chucks will drive taps of a given size indefinitely without breakage.

A cylinder head of a different type, in which twenty-four  $1\frac{1}{4}$ -in. studs are to be set, is shown in Fig. 9, clamped to a special fixture on a radial drill for the stud-setting operation. An Apex friction chuck, similar in construction to the tapping chuck, is also used for stud-setting. The feature of this tool is that the operator can apply full speed until the stud hits the bottom of the hole, thus making it unnecessary for him to "feel his way" as the stud nears the bottom, in order

to make sure that the stud is properly seated without running the chance of breaking the stud off in the hole. When this chuck is used, the friction slips when the stud strikes bottom. The operator then reverses the spindle and backs the holder off the stud, the cam action of a driving pin in the stud setter releasing the pressure on the top of the stud and thus preventing the stud from being withdrawn with the chuck.

The task of setting studs in the various parts of the large units is simplified considerably by the use of an air motor, as shown in Fig. 10. The two mechanics shown in the illustration are using an air motor equipped with an Apex Size "C" stud setter to drive in the four  $1\frac{1}{4}$ -in. studs by which the camshaft bracket is assembled to the cylinder. All studs from  $\frac{3}{4}$  in. to  $1\frac{1}{2}$  in. are driven with this equipment.

A view of the final assembly department is shown in Fig. 11. Each unit is completely assembled before it is considered a finished product. It is then disassembled and shipped, to be reassembled in the customer's plant.

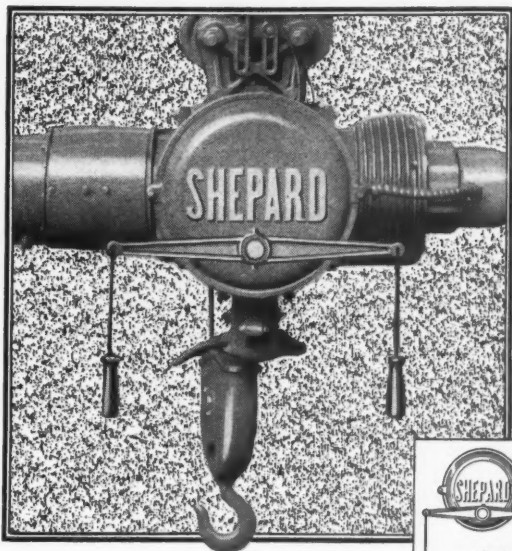
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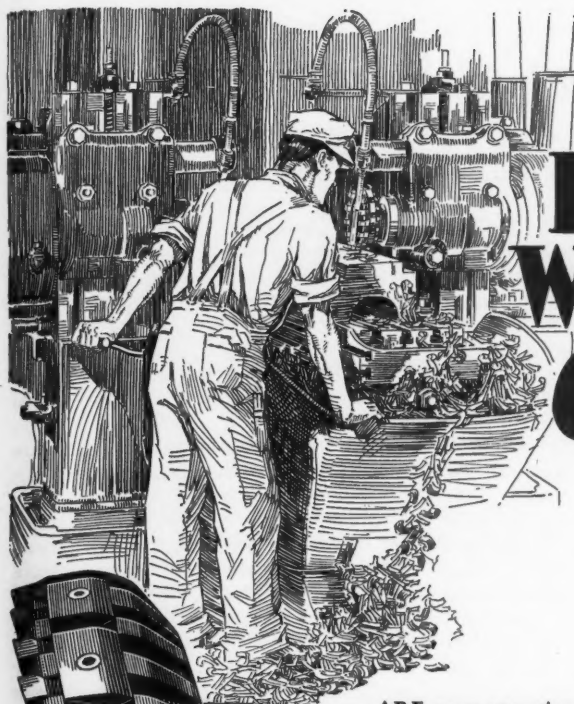
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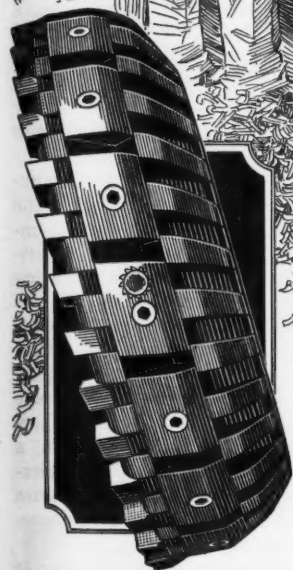
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# Treatment of Stainless Steels

*A discussion of the advantages, properties, and methods of processing of stainless steels*

By R. H. KASPER

ONE of the most outstanding developments in the metal working industries within recent years is the introduction and perfection of the so-called stainless steels. By the use of these steels, the housewife is assured of cutlery which will retain its original polish throughout its life; the automobile owner is relieved of the work of constantly polishing the bright parts of his car; the surgeon can keep his instruments bright and spotless; the laundry business has been able to defeat its greatest enemy—rust, and the chemical and food industries have discovered similar advantages. In addition to the improvement in appearances, the fact that screws and nuts made of stainless steels will not freeze makes the use of this material of particular value in places exposed to the elements or other corroding actions. And, as the corrosion resistant property is inherent in the steel, there is no external treatment which will wear off or peel.

Steels containing more than 12 per cent chromium in combination with a low carbon content are ordinarily classed as stainless. The designation "stainless" is not absolute; although some of these steels are attacked by some acids, the action of most commercial acids is so slow as to be negligible.

Although stainless steels were originally developed for the cutlery trade, various other industries—quick to sense the advantages of the new steel—demanded it. As it quickly became

evident that one analysis could not meet all the various requirements, a number of grades have been developed. However, at the present time, the bulk of the requirements may be satisfied by either one of several grades.

The best stainless properties are found in steel containing approximately 0.30 carbon and 12 - 14 per cent chromium. To develop the greatest resistance to corrosion, heat treatment is necessary from a temperature sufficiently high to cause a complete solution of the carbides. The standard tests for stainlessness are by the use of vinegar and salt, acid copper sulphate solution or cold immersion in 1.20 specific gravity nitric acid.

Owing to the variety of grades obtainable, it is necessary to select the grade most suitable for the work; improper selection of grade will invariably result in failure. In the following discussion, the work operations referred to apply only to the steel suitable to that particular operation. Though the advice of the steel maker should be obtained in selecting a grade of stainless steel for a specified purpose, the following is offered as a guide preliminary to the final selection. Four representative analyses are given with their physical properties and characteristics.

(1) Average analysis: carbon 0.18 per cent, manganese 0.30 - 0.60 per cent, silicon 0.50 - 0.75 per cent, chromium 14 per cent, nickel 1.50 - 2.00 per cent. Maximum hardness, about



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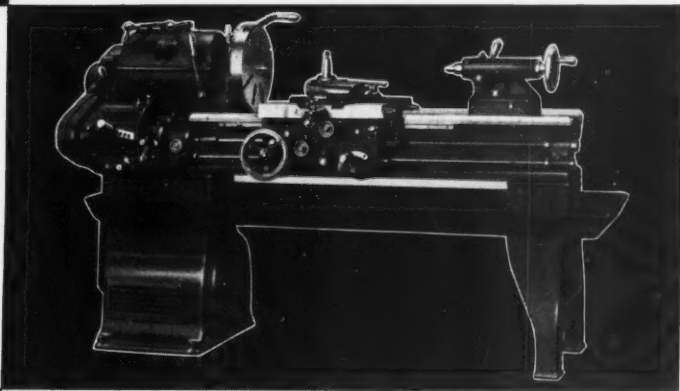
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430 Brinnell, obtained with an oil quench at 1690 degrees Fahrenheit. Normal heat treatment for best machining and anti-corrosive properties, oil quench at 1650 - 1690 and draw at 1150 - 1250 degrees Fahrenheit. Physical properties, normally heat treated, tensile strength 110,000 - 140,000 pounds per square inch; elastic limit 90,000 - 100,000 pounds per square inch; Brinnell hardness 230 - 300.

This analysis is magnetic and cannot be deep drawn. It can be welded with difficulty, but the corrosion resisting properties will be destroyed and air cracks may develop. However, it can be brazed or silver soldered successfully below 1300 degrees.

On account of its great strength, the widest application of this steel is on highly stressed machine parts, such as turbine blades, shafting, piston rods, plungers, spindles and valve parts.

(2) Average analysis: carbon 0.16 per cent, manganese 0.50 per cent, silicon 0.30 - 0.75 per cent, chromium 17 - 20 per cent, nickel 7 - 10 per cent. Brinnell hardness 135 - 145. Normal heat treatment to impart maximum corrosion resistance, ductility and best machining properties; heat quickly to 2050 - 2150 degrees Fahrenheit, cool rapidly in air blast or water. Normally heat treated, tensile strength 85,000 - 95,000 pounds per square inch. Heat treatment is necessary after all hot work above 900 degrees, after welding and after severe cold working. Welding may be performed either by the use of the electric arc or oxy-acetylene torch; resistance welding is possible on sheets up to 16 gauge.

This steel can be fabricated into almost any type of article and can be machined, formed, deep drawn and spun. It is immune against most acid corrosion except sulphuric and hydrochloric, and offers great resistance to abrasion. Unpolished but heat treated,

it is rust resisting in moist atmospheric conditions.

(3) Average analysis: carbon 0.10 per cent, chromium 18 per cent, nickel 9.50 per cent. Does not respond to heat treatment. It is non-magnetic and resists scaling at temperatures up to 1800 degrees Fahrenheit. Tensile strength, hot rolled, 100,000 pounds; annealed, 89,300 pounds per square inch. This steel is ductile and is capable of being cold formed and deep drawn. Tensile properties are increased by cold working. It is very tough and machines with difficulty. It may be gas-welded or welded by the electric arc, and may be hot forged without air hardening.

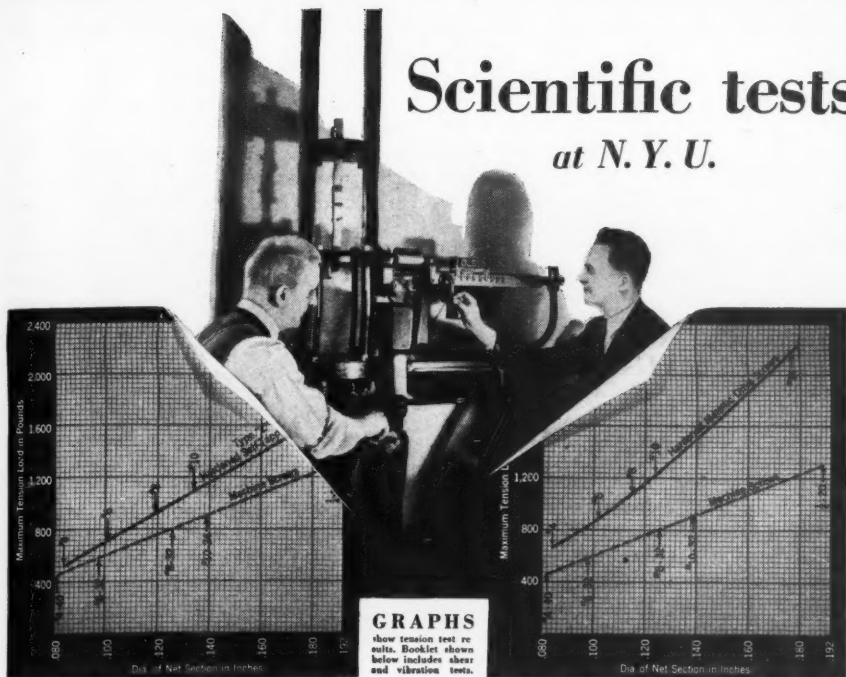
(4) Average analysis: carbon 0.10 per cent, chromium 14 per cent, zirconium sulphid 0.40 per cent. Maximum hardness, 255 Brinnell, obtained by an oil quench at 1825-1850 Fahrenheit. Best machining properties, 187 Brinnell, obtained by air cooling from 1400 Fahrenheit. Tensile strength; annealed, 86,400; hardened, 127,000 pounds per square inch.

This analysis may be machined at the same feeds and speeds as ordinary screw stock. It may be gas or arc welded and hot forged, but trimming should be done immediately after forging. Steel of this analysis is immune to the corrosive action of practically all commercial acids except hydrochloric, hydrofluoric and pure sulphurous acid. The presence of zirconium sulphid adds marked anti-frictional properties. The widest applications are bolts, nuts, gate valves, piston rods and packing glands.

### Forging

Owing to the great strength of stainless steels at elevated temperatures, hot working presents exceptional power demands. At forging temperatures, the ultimate strength of ordinary steels is below 4,000 pounds per square inch; a 15 per cent

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chromium steel has an ultimate strength of 10,000 pounds, and a nickel, chromium, tungsten steel about 12,000 pounds per square inch. Ordinary steels, when heated above 1,000 degrees Fahrenheit, become soft and flow readily under a pressure of 4,000 pounds per square inch; a high chromium steel requires 7,000 pounds, while the addition of nickel results in still greater power demands.

Forging should be done in the vicinity of 2,000 degrees Fahrenheit. At 1600 degrees, reheating is necessary, otherwise cracks will develop, though reheating may be done as often as necessary to produce the desired shape. Cooling from the finishing heat is necessary to prevent air hardening.

### Machining

On most of the grades, machining must be done at reduced speeds with heavy cuts. Side rake of the tools should be about 15 degrees, and the top rake should be greater than for ordinary steels, the angle depending upon the analysis. The tools must be kept sharp at all times. For threading in the lathe, best results are obtained by the use of a fine pitch lead screw.

For drilling operations, the drill must be kept sharp at all times and must not be permitted to ride on the metal without cutting, as friction will cause hardening. If a center punch is used for laying out the position of holes, the point should be ground triangular, so that the cutting lips of the drill will take hold of the metal immediately. The work should be backed up well underneath, so that the metal will not be pushed away from the point of the drill as it approaches the bottom. Either the usual speeds as for mild steels, with a finer feed, or the usual coarse feeds with a slower speed should be used. On most cutting operations, a lubricant composed of one pound of sulphur to

a gallon of lard oil will give good results.

### Punching

Owing to the ductility of the stainless steels, which may be anywhere between 15 per cent and 35 per cent greater than mild steels, they will not break or fracture after the punch has passed partly through the stock. There is also a tendency for the metal to drag into the clearance space of the die, therefore the fit between punch and die must be closer than ordinarily used for the same thickness of material.

### Forming and Drawing

While the generally accepted principles of die design are applicable, there are a number of differences which have been found necessary by experience. Although stainless steels are more ductile than ordinary carbon steels, the ductility decreases faster during drawing operations, due to their cold work hardening properties. The yield point is higher, necessitating a greater allowance for spring-back in forming operations. As the yield point on soft sheets may vary from approximately 35,000 to 65,000 pounds per square inch, the allowance must vary accordingly.

Ordinarily more power and slower speeds are required for forming and drawing than can be used on mild steels; thus, owing to the increase of pressure required, a severe abrasive action is placed on the working surfaces of the dies. This is overcome partly by increasing the clearance space between the dies and partly by the use of special lubricants. The average clearance should be approximately 0.010 inch above the thickness of the stock, although much depends upon the shape of the product, and it may vary, at certain points, up to 3/32 in., where there is a tendency to buckle, wrinkle or stretch. Where the drawing strains are very severe,

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it may be found necessary to provide draw beads to permit the metal to flow freely without using excessive pressure, which would increase the possibility of breakage.

The average maximum draw is a reduction of 50 per cent; in other words, a blank of a specified diameter may be drawn into a cup of approximately one-half the diameter of the blank. For a specified depth of draw, stainless steels require a greater number of drawing operations than mild steel, the ratio being about five to three. In most cases, a blank somewhat larger than ordinarily used will give best results, as a greater area is thereby provided for anchoring by the pressure pads.

To resist the abrasive action on the working surfaces of the dies, bronze rings and inserts have been found to give good results. However, where the cost of bronze inserts has been objectionable, close grained cast iron, heat treated, has been found quite satisfactory. All working surfaces must be finished with an oilstone, as any irregularities and emery scratches will show on the work, necessitating prolonged polishing.

The choice of a drawing lubricant depends upon the thickness of the material, and the size and shape of the blank. The choice of a satisfactory lubricant must be determined by experiment, though the following lubricants have been used successfully: (1) engine oil and cup grease, (2) soluble oil and white lead compound, (3) lithophone, cup grease, sulphur, talcum powder and paraffin oil. The proportions of the ingredients must be varied to suit the requirements. In all cases where heat treatment is required between draws, the lubricant should be water-soluble so that it may be entirely removed before the heat treatment, to prevent carbon pick-up. On final drawing operations, and in cases where only one draw is neces-

sary, the lubricant may be allowed to remain for the polishing operation.

### Grinding and Polishing

Though the corrosion-resistant properties of stainless steels are primarily produced by the composition, these properties are quite as dependent upon the final grinding and polishing operations. All pits and spots must be entirely removed, otherwise electrolytic action will start at these points.

The amount of grinding and the grits employed depend upon the surface condition of the mill sheets and the work performed upon them. In all cases, the abrasive should become progressively finer as the work proceeds, as it is necessary that all marks and scratches from the previous grinding be entirely removed. In general, it may be stated that for hot rolled sheets, grits from 80 to 200, spread over five or six applications, will give good results. For cold rolled strips, grinding may be done with grits from 120 to 200, with one or possibly two applications eliminated.

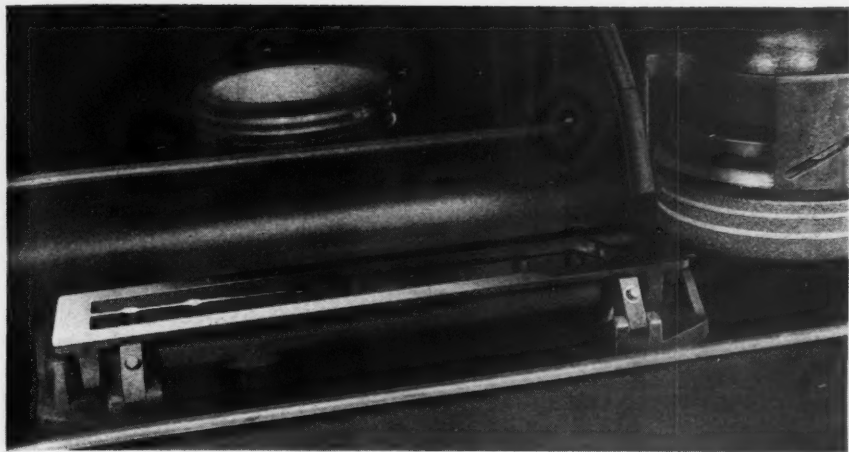
### Heat Treatment

So far, very little has been mentioned on the subject of heat treatment. This subject has intentionally been given little more than passing notice, for the reason that each particular analysis requires a different treatment. The work performed on the material and the proposed uses of the finished product also have some bearing on the heat treatment required. However, a brief, general statement may not be amiss.

The mechanical properties of stainless steels may be varied by quenching at different temperatures; the lower heats give better mechanical properties, but always at a sacrifice of hardness and corrosion resistance. Oil quenching is usually practiced, al-

(Continued on page 48)





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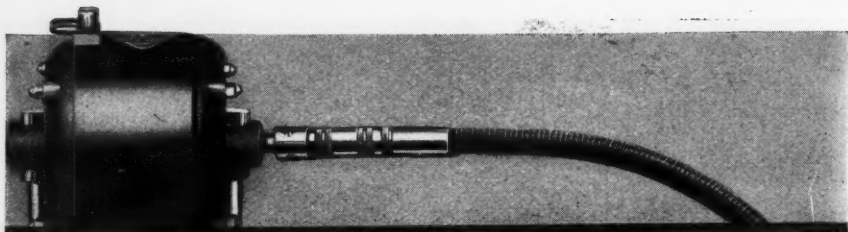
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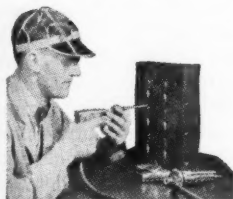
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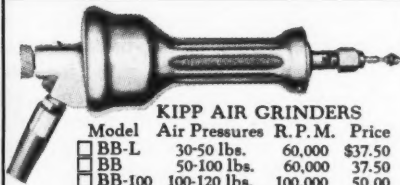
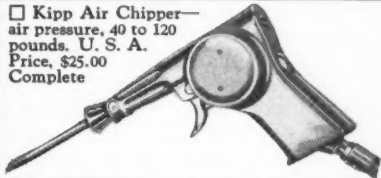


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# What Are "Accurate Costs"

By WALDO HUTCHINSON

CONSIDERING the subtle influence that the costs reports are expected to impart to other departments of the business, it is truly remarkable with what crude methods the original data is often assembled. Almost every department looks to the cost department for guidance in one or more of its activities. Incorrect information from this source has often caused the ruination of a business.

Some cost departments seem to operate on the assumption that all that is required of them is some sort of estimate as to the cost of doing business. This haphazard line of attack may have been acceptable in those dear dead days when "Cost plus Profit equalled Selling-Price," but now-a-days, when we begin with a selling-price, and then try to manufacture to that figure—squeezing out a profit, if possible—nothing but hair-line accuracy should be accepted from the cost department. In fact, such accuracy is imperative for the reason that competition being what it is, we must shave the ultimate penny from the cost of production. The first essential in this work is a knowledge of exactly what those costs are.

One of the most common sources of inaccurate cost information is the abuse of the "Overhead" columns on the cost sheets. In some organizations these columns have degenerated into dumping grounds for all items which

*An article advocating more accurate cost finding by diverting more items from "overhead" to "direct" in labor charge posting; and suggesting the use of the adjectives "Productive" and "Non-Productive" in differentiating between the standardized and the unstandardized portions of Direct Labor.*

someone was too lazy to investigate closely enough to discover its rightful "job number." For example, a machine operator kills three extra hours in setting up his machine. Not wishing to burden the job with the lost time he charges "Repairing Machine" with the three hours. A

trucker whose regular time goes to an "Overhead" number spends an entire day unloading a lot of new castings for a certain job. Instead of charging the job, he makes out his time ticket to the customary overhead number. A gang-boss supervises an assembly line producing a certain product. Rather than place the expense where it belongs—on the job itself—he charges his time as "Department Supervision," and it is entered as "Overhead."

Tool-makers, repairmen, stock-handlers, oilers, gang-bosses, maintenance men, clean-up men, in short, all classes of labor who spend their time directly on one or more "jobs" should be instructed to charge their time, as far as is practicable, to specific numbers rather than to some general account.

There is another class of work which needlessly and wrongly swells the already over-loaded Overhead accounts. This is in the group handling of small parts for tumbling, cleaning, spray - painting, and so

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POUGHKEEPSIE, N. Y.



on, where individual handling is deemed inefficient. With a little effort on the part of the operator, foreman, timekeeper, or whoever marks the job-tickets, the time so spent could readily be pro-rated against the separate job numbers affected. These operations are in **no sense** overhead, and to consider them as such is merely to increase the error in the collection of cost figures.

An important point to be borne in mind in the charging of labor is that the greater the total overhead, the less accurate will be each ultimate cost figure. Small items are burdened with charges away out of proportion to their size as cost-creating items. Large elements do not carry their true share of the cost load, and reflect a minimized charge as cost-creating items. The surest means to securing accurate quotations is to eliminate as much as possible of all overhead charges.

Another great source of misleading cost data is the popular confusion of the adjectives "Direct" and "Productive," and their negatives, "Indirect" and "Non-Productive." Some cost accountants divide their labor into "Direct" and "Indirect." There are others who—having in mind the same distinction—prefer to call them "Productive" and "Non-Productive." In each case the former is considered chargeable in full to a job; and the latter is taken as overhead.

It is readily apparent, however, that in order to indicate leaks or inefficiencies in "set-up time," "reloading machine," "special grinding of tools," "special oiling of machine," "discarding scrap," and so on, which are not standardized as is the actual "running" or "operating" time, some distinction must be made between the first five and the latter two, in report-

ing the time. While both of these classes are "Direct" labor, only the latter class is "Productive;" the former being "Non-Productive," and susceptible to improvement. Hence it is very important to segregate the "Productive" from the "Non-Productive" labor, (although both, of course, are direct and chargeable to the job.) Productive time is always spent actually processing parts.

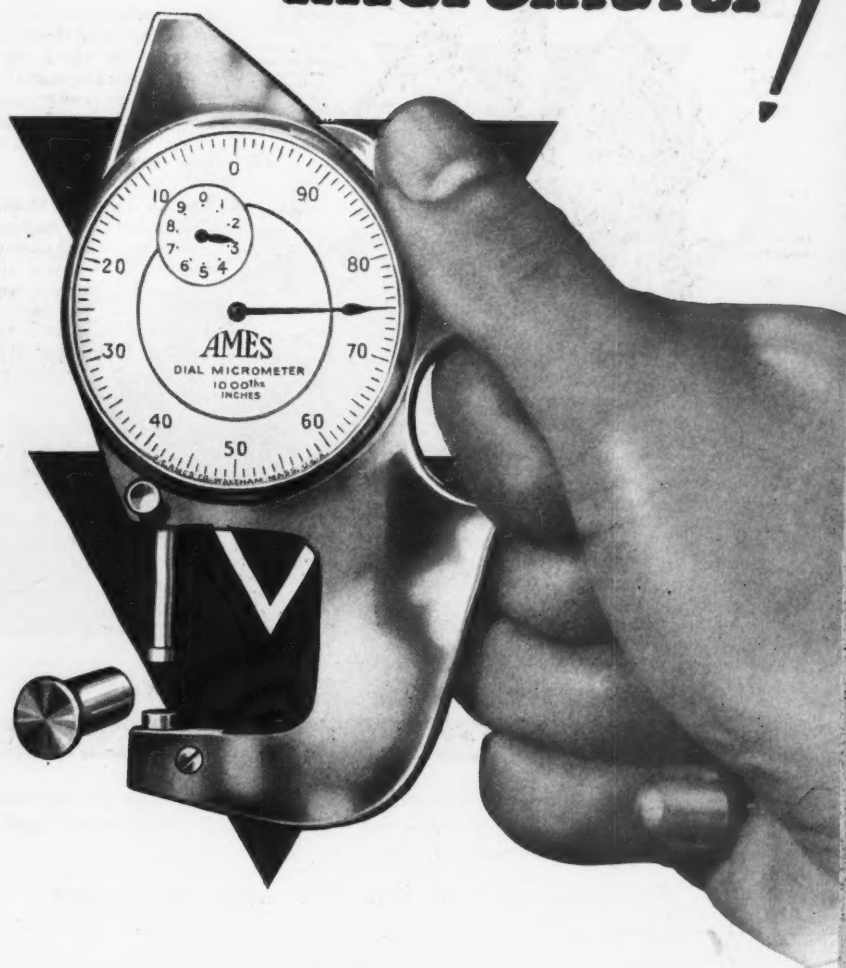
So, in the interest of shop efficiency, the definitions of these terms should be more clearly understood. As a matter of record, it is the "Direct—Non-Productive" labor upon which most cost reduction work can be performed. The writer is well aware that the inexact connotations of the words herein referred to possess a dignified aura of years of service, and he has no desire to increase the already infinite red-tape of cost finding. Neither would he be the one to split hairs over fine distinctions purely "in the interest of science." Nevertheless, as Industrial Engineer, he has often been painfully conscious of a cost department's inability to produce concrete data, actually indicating where irregularities, inefficiencies, and leaks should be looked for. Again, he realizes the cost department's strategic position in the eternal war against waste; and knows that an appreciation of this position by cost accountants generally would place many a run-down cost department on a paying basis, and overthrow any suspicion that it is a purely parasitic institution!

It may be an excellent plan to make a thorough survey of every class of work in the plant with a view to determining exactly what sort of "job ticket" charge should be made for each. It would be well worth while to arrange some sort of educational

(Continued on page 60)

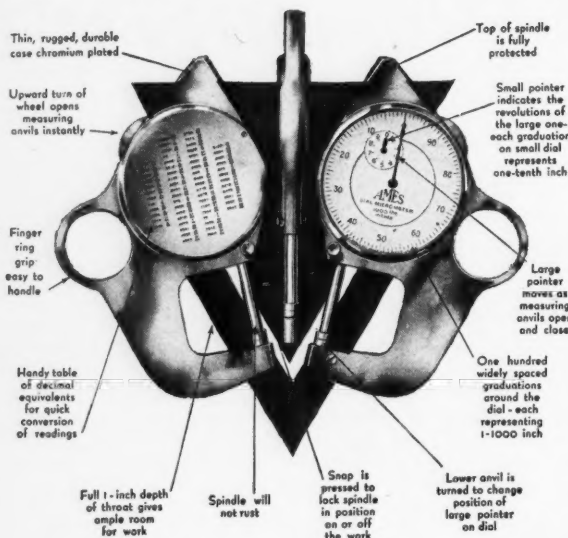


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# Milling and Grinding In the Railroad Shops

By H. H. HENSON

**T**WENTY years ago a milling machine was a comparatively rare article in a railway repair shop, and cylindrical grinding machines could be found only in a few shops that were regarded as far in advance of the general run of the industry. Even

The "rolling" process which in former years was considered plenty good enough for finishing piston rods and other cylindrical parts has largely been discarded for the grinding method, both because a ground shaft is really straight—not finished with

a series of curves resembling an artist's conception of ocean waves—and because a shaft can be ground in much less time than it can be rolled. Also, it can be finished much more accurately, which in these days is important. The railway shop mechanic who laughed at the idea of working to thousandths of an inch

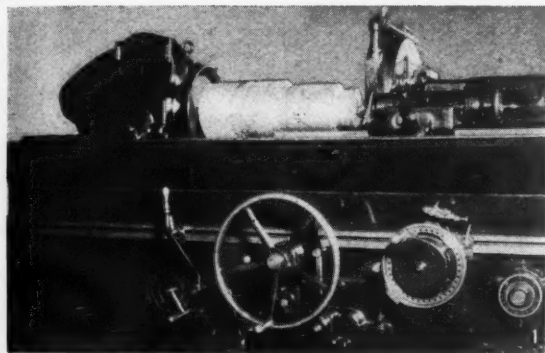
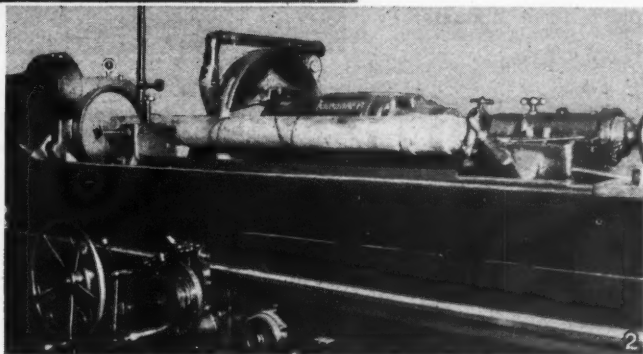


Fig. 1—Grinding a locomotive crank pin in an 18 x 40 x 96-in. gap grinder.  
Fig. 2—Finishing a new piston rod to size.



ten years ago the milling machine was a curiosity in most railway shops, and the grinder had made but little headway. But in the past ten years both the grinding and milling machine have been taken into the railway family, and now a locomotive repair shop without an adequate supply of these machines is considered a back number indeed.

twenty years ago would quickly be laughed out of the shop if he didn't know how to read a micrometer in these days.

Probably the most common use to which the grinder is put in the loco-

motive shop is that of grinding crank-pins and piston rods. Figure 1 shows a modern cylindrical gap grinder in

stems, valve motion pins, driving axles, and other cylindrical parts. The matter of economy recommends the cylindrical grinder for re-finishing worn piston rods and air pump piston rods, as the amount of stock removed is held to the minimum, thereby giving the rods longer life in service.

In Fig. 2 a new piston rod of the larger size is shown in process of fin-

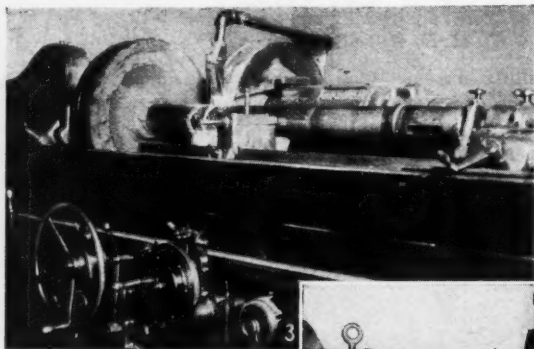
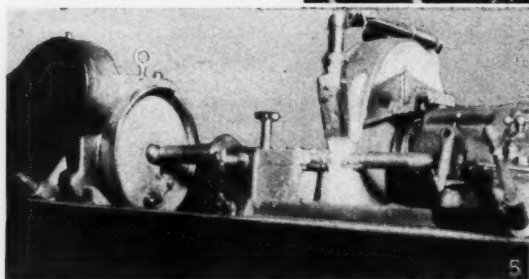
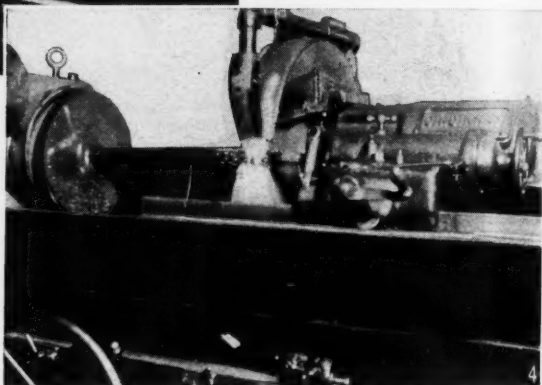


Fig. 3—The piston rod with head attached is put into the grinder for refinishing. Fig. 4—Refinishing air pump piston rods. Fig. 5—The milling machine arbor shown in the machine was finished within 0.0001 in. of size by a two-year apprentice.

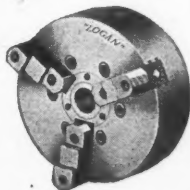
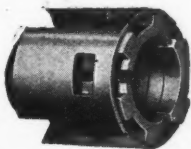
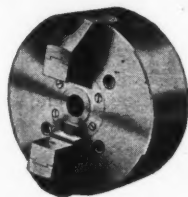
process of grinding a crank pin for a Santa Fe type locomotive. The pin is 10 in. diameter by



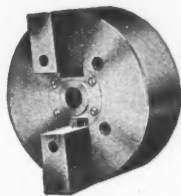
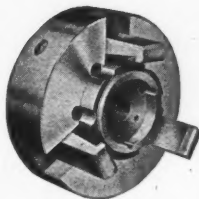
ishing before the head has been assembled to it. In Fig. 3 a worn piston rod—head and all—is shown in place in the machine for refinishing. Fig. 4 shows how the grinder is adapted for refinishing piston rods for air compressors. The piece shown in process in Fig. 5 is a milling machine arbor which was finished to within 0.0001 in. of finish size—practically an impossibility by any other method. All of the parts shown in the preceding illustrations were finished by a two-years' apprentice.

28 in. long. These crankpins are rough turned to within 0.025 or 0.030 in. of the finish size, then they are finished by grinding, as shown. The same amount of stock is allowed for grinding on new piston rods, valve

stems, valve motion pins, driving axles, and other cylindrical parts. The matter of economy recommends the cylindrical grinder for re-finishing worn piston rods and air pump piston rods, as the amount of stock removed is held to the minimum, thereby giving the rods longer life in service.



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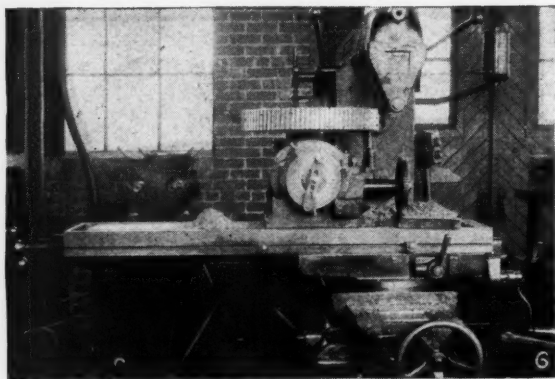
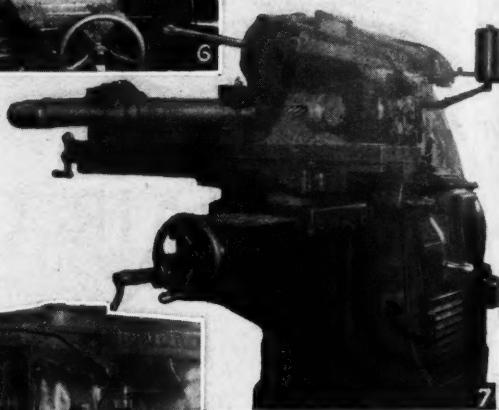
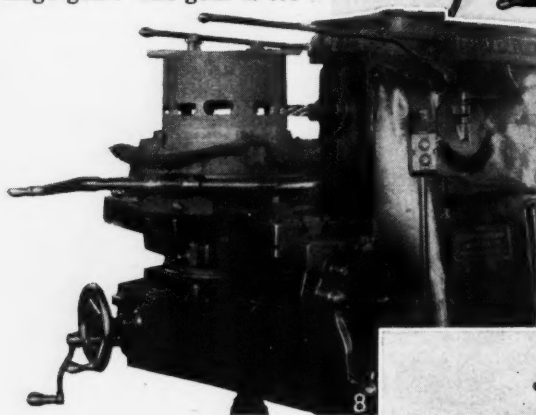


Fig. 6—Using the milling machine to cut teeth in a large gear. Fig. 7—Keyways in piston rods are also cut with the milling machine.

In Fig. 6 is shown a universal milling machine, set up to cut the teeth in a large gear. The gear is too



past the cutter vertically. Fig. 7 shows the operation of milling a keyway in a locomotive piston rod, using a helical cutter. This operation is completed within 15 minutes after being set up. The hole through which the cutter is inserted

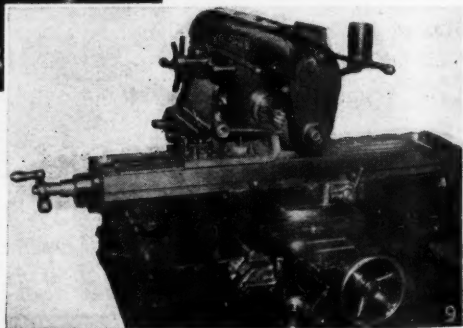


is drilled on the milling machine, also.

In Fig. 8 a valve chamber bushing is shown set up on the table of a milling machine to have the  
(Continued on page 42)

Fig. 8—Milling steam ports in a valve chamber bushing. Fig. 9—Milling the teeth in a throttle lever quadrant.

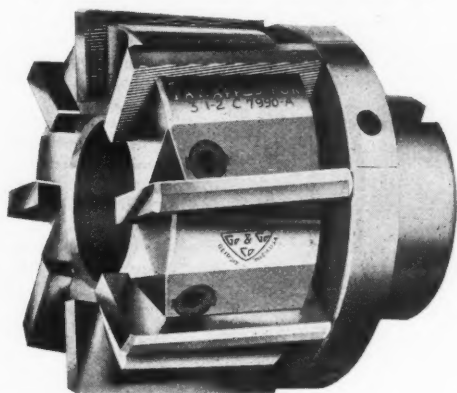
large to be swung between centers, so the dividing head was set with the face plate in a horizontal position and the teeth were cut by feeding the work





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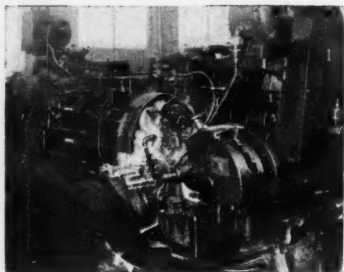
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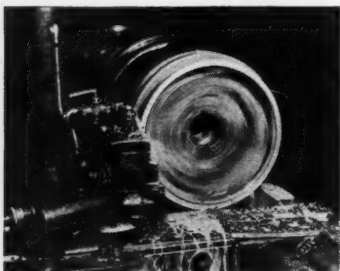
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FACE SQUARE WITH HOLE WITHIN .00025 IN.  
BY INDICATOR.  
**MACHINE:** GRIDLEY 4 SPINDLE 4 IN. CHUCK-  
ING MACHINE.  
**MATERIAL:** MALLEABLE IRON.  
**CUTTING SPEED:**  
ROUGH AND FINISH FACE 131 FT. PER MIN.  
ROUGH AND FINISH BORE 42 FT. PER MIN.  
ROUGH AND FINISH TURN 131 FT. PER MIN.  
ROUGH AND FINISH REAMING 43 FT. PER  
MIN.  
ROUGH AND FINISH CHAMFER 131 FT. PER  
MIN.  
OIL GROOVING.  
**SPINDLE SPEED:** 186 R. P. M.  
**LUBRICANT:** 1 PART SUNOCO TO 10 PARTS  
WATER



Courtesy of  
Bates-Wahlert  
Company,  
Lansing,  
Mich.

**OPERATION:** FACING TWO SIDES OF 15 IN.  
STARTER GEAR BLANK.  
**MACHINE:** LE BLOND HEAVY DUTY LATHE.  
**MATERIAL:** .50 CARBON STEEL.  
**WIDTH OF CUT:** 0.75 IN.  
**TOOLS:** CIRCLE C.  
**FEED:** 0.043 IN.  
**SPEED:** 130 SURFACE FT.  
**LUBRICANT:** 1 PART SUNOCO TO 20 PARTS  
WATER

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Sunoco is adaptable to all types of boring, turning, facing and grinding operations that require accurate, speedy, economical production.

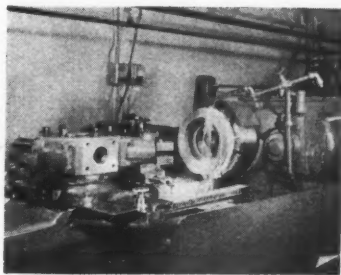
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*The Sun Oil Company produces a type of cutting oil to meet every metal-cutting requirement.*

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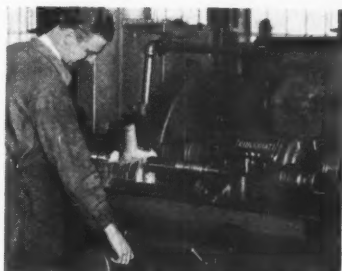
OPERATION: TURNING, BORING AND FAC-  
ING TRANSMISSION GEAR BLANK.  
MACHINE: 1-H. LIBBY LATHE.  
TOOLS: CARBOLOY.  
MATERIAL: NICKEL STEEL.  
STOCK REMOVED: 1/4 IN.  
SPEED: 94 S. F. P. M.  
TIME PER PIECE: 14 MINUTES.  
LUBRICANT: 1 PART SUNOCO TO 15 PARTS  
WATER.

SUNOILCOMPANY, Ltd., Montreal, Canada.

# SUNOCO

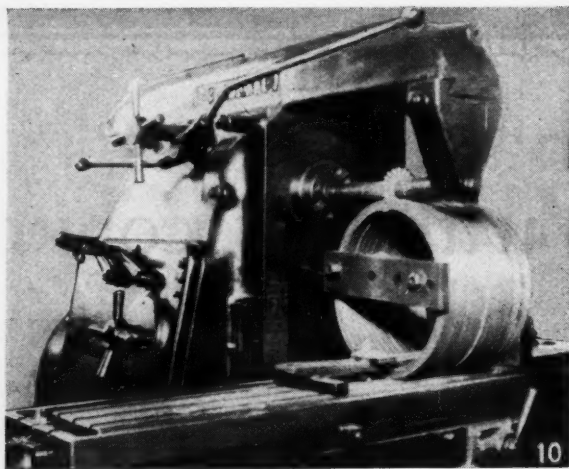
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of BLUE SUNOCO MOTOR FUEL

Courtesy of  
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Grinders,  
Inc.,  
Cincinnati,  
Ohio



OPERATION: ROUGH GRIND SEVEN  
SPINDLE DIAMETERS.  
MACHINE: CINCINNATI 14 IN. X 48 IN. PLAIN  
SELF-CONTAINED GRINDER.  
MATERIAL: S. A. E. 3145 HEAT-TREATED  
STEEL.  
STOCK REMOVED: 0.40 IN.  
LIMITS: .001 IN. ON ROUGH GRIND.  
GRINDING WHEEL: 30 IN. X 3 IN. X 12 IN.  
ALOXITE 40 N 37.  
LUBRICANT: 1 PART SUNOCO TO 40 PARTS  
WATER.

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(Mich.), Jacksonville, Miami, Montreal, Newark, New York, Ottawa,  
Scranton, Syracuse, Tampa, Toledo, Toronto, Trenton, Tulsa, Wilmington.



### Railway Milling and Grinding

(Continued from page 38)

steam ports milled out. The bushing is clamped to a circular milling attachment, and a helical cutter is used to remove the stock. With this outfit a smooth, accurate cut can be obtained. The piece shown set up on the milling machine table in Fig. 9 is a throttle lever quadrant in which the teeth are to be milled with a special cutter. The piece is held by a bolt at the rear end and supported as closely as possible to the point where the teeth are to be cut. The operation of cutting these teeth was formerly performed on a shaper, and required from five to six hours' time. By milling the teeth as shown in the illustration, the job can be completed within three minutes after the piece is set up.

A gang of piston valve rings is shown in Fig. 10, set up to have the slots milled. These rings are bored and turned as a solid casting on the boring mill, and are cut off with a parting tool held in the side head of the mill. Then they are clamped together on the milling machine table as shown in Fig. 10 and a  $\frac{1}{4}$ -in. slot

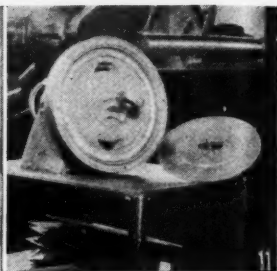


Fig. 10 — Slotting piston valve rings. Fig. 11—The rings are compressed and turned to size in this chuck.

is milled. After milling, the rings are compressed, one at a time, and turned to size in the chuck shown in

Fig. 11. The turning operation is performed in an engine lathe. Rings finished by this method are perfect as to fit.

### All Steel Inclinable Power Presses

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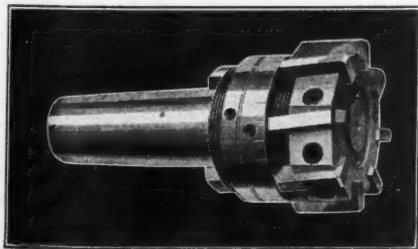
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# The Law of Contributory Infringement of Patents

By LEO T. PARKER

Attorney-At-Law, Cincinnati, Ohio

**C**ONTRIBUTORY infringement is an indirect infringement usually surrounded by obscurity, which to the average misinformed person renders the indulger free from liability as a result of the obscurity.

A most common legal controversy which involves contributory infringement is where two or more persons endeavor by separate acts to obtain the benefits from the sale, manufacture or use of a patented article without incurring liability for infringement. Frequently manufacturers manufacture all but one part of a patented invention and impart information to purchasers which results in an indirect infringement. In other instances, a person may purchase several parts or accessories from different sources and assemble an infringing device. All persons who assist in the manufacture and assembling of the parts are liable if they were informed of the intended use of the various parts.

Another important point of the law is that the infringement acts of two or more persons or firms may be collectively prosecuted by a patentee, and the Court will consider the ultimate result in determining whether an infringing act has been committed. In other words, collective or contributory infringement is determined by the same legal procedure as where the infringing acts are accomplished by a single person. Moreover, in cases where contributory infringement is proved to exist, the guilty persons are liable for payment of the full profits

earned, plus the amount of damages incurred by the patentee, and where the infringement clearly is intentional and willful the Court will render a verdict in favor of the patentee for *three* times the profits earned by the infringers, plus three times the damages caused the patentee.

## Who Are Contributory Infringers?

The distinction between ordinary infringement of a patent by a single person or firm and contributory infringement by a plurality of persons is: In the former the infringer is liable in damages although he proves conclusively to a Court that the infringement was unintentional, whereas no person is liable for contributory infringement unless the evidence proves or the circumstances conclusively indicate that the infringing acts were intentionally committed.

In the leading case of *General Electric vs. Sutter*, 186 F. 637, a higher Court explained the acts consisting of contributory infringement, as follows:

"The legal principles governing contributory infringement exists where one *knowingly* *concerts* or *acts* with another in an unlawful invasion of a patentee's rights. If assistance is given by furnishing an essential part of an infringing combination and the part furnished is adapted to no other *than* an *infringing* use, such contribution makes him a contributory infringer. On the other hand, if the part furnished is adapted to other and lawful uses, in addition to infringing uses, then an *intent* to furnish for infringing use must be established be-



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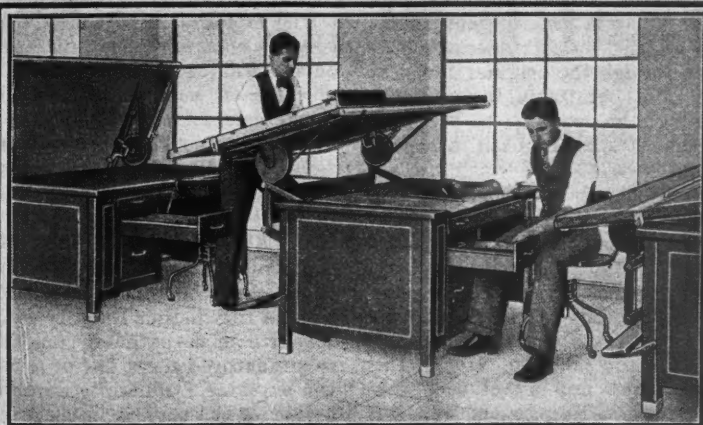
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fore the furnisher can be held a contributory infringer."

Sometimes the circumstances surrounding the infringement are such that a Court will rely upon convincing circumstantial evidence which conclusively indicates that contributory infringement was intentional, although actual proof is not supplied.

For example, in *Sandusk vs. Delevord*, 274 F. 608, a patentee sued a manufacturer who made a device that was not actually an infringement, but which was constructed in such a manner that a simple and apparent change on the part of a purchaser transformed the device into an infringing article. The testimony indicated that the manufacturer was aware that purchasers would make the change which would transform the non-infringing device into an infringing one. Therefore, the Court promptly held the manufacturer liable as an infringer, and in effect said:

"Where a person manufactures a device capable of an infringing use and sells it *with the intent* that it shall be so used, he infringes the patent, even though the original device is capable of a non-infringing use and even though he explains to the purchaser that it shall be used in a non-infringing way."

In many other instances adverse verdicts have resulted where the testimony proved that persons have sold a part of a patented article and explained to purchasers how it, in combination with other parts, was capable of being made and assembled into an infringing structure. In cases of this kind the dealer and all of the users are liable as infringers, as was this dealer.

In still another case a dealer was held liable as an infringer where it was shown that he advertised and sold only one part of a patented article, although the claims of the patent were

not infringed by the selling of this one part. However, in the advertisements he explained how the part could be used with other parts which when assembled comprised an infringing device. Of course, neither a manufacturer, seller, nor a user is liable for infringement where only one part of a patent device is manufactured, sold and used, providing the part is not specifically covered by the claims of the patent, and the purchaser is not informed how he may use it to avoid payment of royalty fees to a patentee.

It is also important to know that the owner of a patent is privileged to sue either the manufacturer, seller, or user of the invention, or all of them, whereby the patentee is enabled to forestall extensive infringement with little difficulty. However, the owner of an infringed patent usually sues the maker, and after infringement is established in the Courts he may obtain an injunction to prevent the continuation of the infringement by other parties.

The fact that a person who *makes, contrives or purchases* an infringing device and uses it in the conduction of his own business is liable for infringement enables a patentee to obtain a judgment for profits and damages from all persons involved in the infringement.

#### Right To Manufacture Parts

Frequently the operators of machine shops are confronted with the question as to whether liability may exist if parts of a patented machine are manufactured for a patron who is not the patentee. Generally speaking, the owner of the shop is liable if the part is separately protected in the claims in the patent, irrespective whether he intentionally infringes the patent. Under these circumstances the owner of the shop is not a contributory infringer because he performs the work



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of making the complete patented article.

An excellent example of this latter situation is found in *Drinking Co. vs. Evertt*, 300 F. 958. Here it was disclosed that the claims in a patent protected a machine for vending paper cups. Also, the drinking cups were separately protected in combination with the machine. A firm made the cups and sold them without obtaining a license from the patentee. The Court held the maker liable for infringement and explained that anyone who sells the cups with knowledge that they will be used in the machine directly contributes to the eventual infringement "and does so with his eyes open."

It is not necessary for the owners of machine shops to refer to patents to learn if they are liable for manufacturing common-place parts such as gears, knives, frames, levers and the like, although the parts are to be utilized by the purchasers to construct patented devices. This is true for two reasons, first, because no inventor can obtain a patent on a well-known and commonly used thing on which patents have long since expired, although the inventor includes the part in a patented construction. Second, although the part being manufactured is not common-place and *is protected* in the combination of elements claimed in the patent, the mere fact that the part is being made without consent of the patentee does not render an innocent maker liable for contributory infringement.

For example, in a leading higher Court case it was disclosed that the owner of a plant made and sold parts of a patented device. He did not intend or know that the customer would use them in constructing an infringing device. Therefore, the Court held the proprietor not liable for infringement and in effect stated the following law:

"The question is whether or not the

parts were made and sold *with intent* of aiding another person in the unlawful making, selling, or using of a third person's patented invention. . . . The mere fact the parts were capable of such a use is not sufficient to establish an intention."

Generally speaking, a machine shop owner may furnish ordinary parts for repairs on a patented machine or device, but he is liable for infringement if he practically reconstructs a worn-out machine.

However, a recent United States Court in *Harrison vs. St. Louis*, 77 F. 740, explained the law on this subject concisely and clearly, as follows:

"The rule is established that a person. . . has the right to repair a part of the machine or device which happens to be broken through accident, or which becomes so far worn as to render the machine inoperative, provided the machine, as a whole, still retains its identity. . . . And provided, further, that the part so replaced is not separately covered by a patent. . . . The fact that the device is patented does not lessen the owner's right to put it in order when it gets out of repair, unless considered as a whole, it is worn out and useless. When a patented machine is accidentally destroyed, or when it is practically worn out, the owner thereof, under the guise of repairing it, cannot make a new machine. In such cases, he must cast it aside and buy a new one from the patentee."

## Treatment of Stainless Steels

(Continued from page 26)

though air blast cooling is satisfactory on light sections, even though at a sacrifice of hardness. Thorough preheating is necessary, and, due to the low heat conductivity of the material, a lengthy soaking at quenching heat is necessary.

## STANDARD & SPECIAL DRILLING & BORING MACHINES

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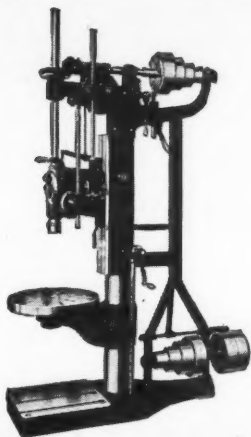
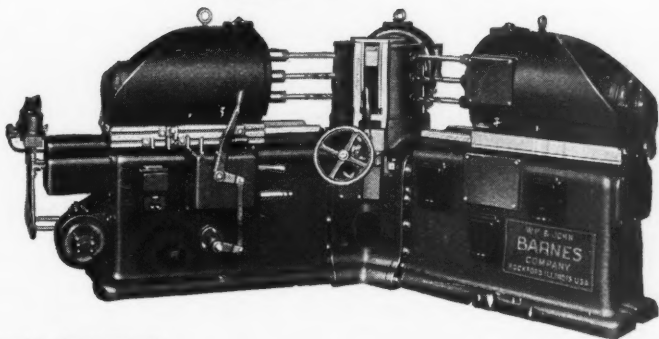


Illustration at left shows 26-inch Sliding Head Drill with Power Feed, Automatic Stop and Back Gears, arranged for belt drive.



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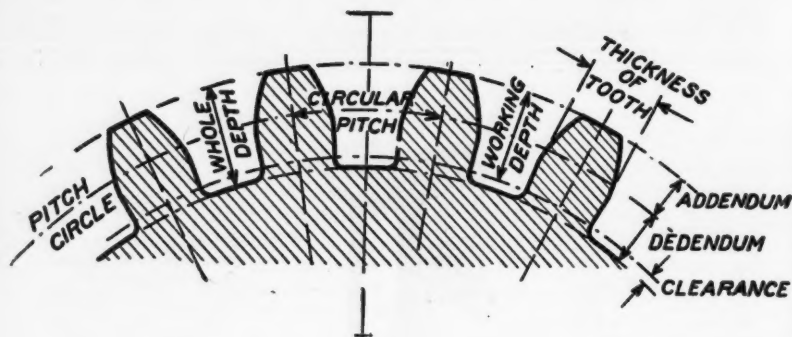
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PRODUCTION  
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## Definitions of Spur Gear Tooth Parts

The **CENTER DISTANCE** of a pair of gears is the shortest distance between the centers of the shafts on which they are mounted.

The **PITCH CIRCLES** of a pair of gears are of the same diameters as a pair of friction rolls which would fill the same center distance.

The **PITCH DIAMETER** of a gear is the diameter of its pitch circle. This is the dimension upon which all calculations for gear-sizes are based.

The **DIAMETRAL PITCH** is the number of teeth on the gear per inch of pitch diameter.

The **CIRCULAR PITCH** is the distance from the center of one tooth to the center of the next, measured on the pitch circle.

The **SIZE** of a gear tooth is designated by its pitch; a 10 pitch tooth has an addendum of  $1/10$  inch and a dedendum of  $1/10$  inch.

The **TOOTH THICKNESS** is measured on the pitch line, and is equal to one-half the circular pitch.

The **ADDENDUM** is the height of the tooth above the pitch line.

The **DEDENDUM** is the theoretical depth of the tooth below the pitch line, and is the depth to which the teeth of the mating gear extend. To this is added the clearance.

The **WORKING DEPTH** is the sum of the addendum plus the dedendum.

The **CLEARANCE** is the amount by which the tops of the teeth of one gear clear the bottoms of the spaces between the teeth of the other gear.

The **WHOLE DEPTH** is the dimension from the top of the tooth to the bottom of the same tooth, and includes the addendum, dedendum, and clearance.

The **OUTSIDE DIAMETER** is the diameter of the circle formed by the tops of the teeth.

The **ROOT DIAMETER** is the diameter of the circle formed by the bottoms of the tooth spaces.

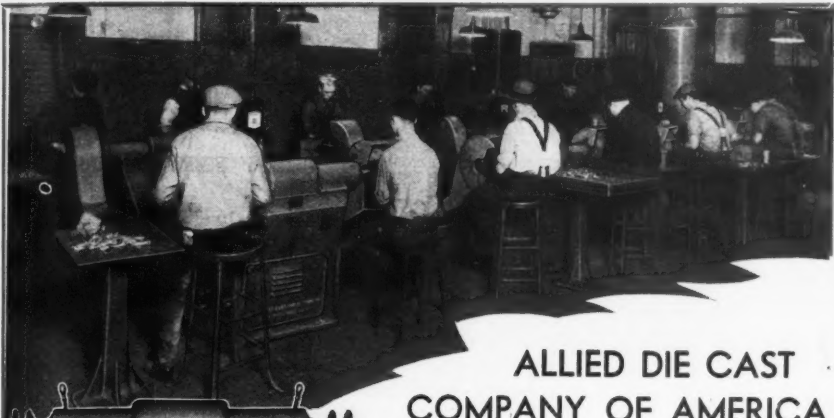
The **FACE** of a gear tooth is that part of the tooth outline which extends above the pitch line.

The **FLANK** is that part of the tooth outline extending below the pitch line.

The **FILLET** is the rounded corner where the flank of the tooth curves to join the bottom of the tooth space.

The **BACKLASH** is the difference between the thickness of a tooth and the space into which it meshes, measured on the pitch circles.





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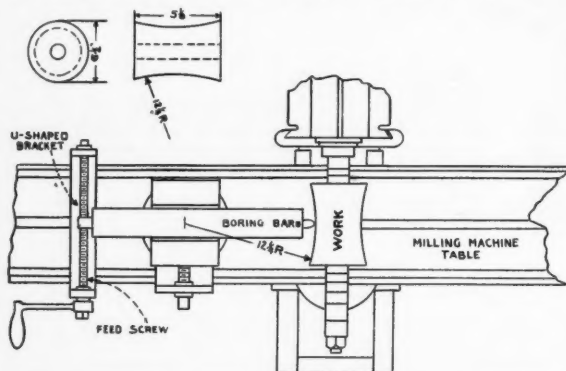
## Ideas From Readers

*This department is a clearing house for ideas. If there is a "kink" or short cut in use in your shop, send in a description of it. We will pay \$5 for each one published.*

### Turning a Radius In the Milling Machine

By CHARLES KUGLER

I HAD six cast iron pieces to machine, each  $5\frac{1}{8}$  in. long and  $6\frac{1}{2}$  in. in diameter at the ends, to be



Equipment Used to Turn a Radius In the Milling Machine.

turned on a  $12\frac{1}{4}$  in. radius as shown in the upper part of the illustration. I proceeded to turn the pieces in the lathe, but when I came to machine the radius, I discovered that the lathe was too small to allow the turning of a radius of the dimension given. The only alternative was to turn the radius in the milling machine, which I did with the equipment shown.

A swivel vise was clamped to the machine-table and in the vise was clamped a boring bar, with the point of the tool  $12\frac{1}{4}$  in. from the center of the vise-pivot. To the rear end of the bar was attached a nut, which,

in turn, was threaded onto a feed screw. The feed screw was held in place by a length of bar iron, bent up and drilled at the ends to provide bearings for the feed screw, and bolted firmly to the table of the machine. The holes for the ends of the screw were elongated, horizontally, so that the screw could swing through the prescribed arc without binding. A crank on the end of the feed screw provided means for feeding the bar back and forth as required.

The work was placed on the arbor of the milling machine, as shown, and as the hole in each of the pieces was 1 in. in diameter, it just fitted a 1-in. arbor. It was found necessary to clamp the vise just tight enough to eliminate vibration, while giving it sufficient freedom so that it could be swung back and forth. The overhanging arm of the machine was used, although it has been omitted in the sketch so as to allow a better view of the set-up.

### Universal Jig Plate

By P. L. BUDWITZ

HOLES in tools, dies, and similar work can be laid out or drilled and bored accurately and rapidly by



Single Close Coupled Type  
Twin Disc Clutch

# TAKES A HEAVIER LOAD..

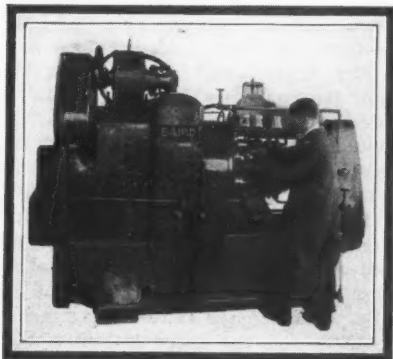
Six spindles . . . operating five pieces of work at one time, with different combinations of speeds for the spindles . . . and the sixth spindle in a position for loading and unloading—that's the Baird Multiple Spindle Lathe.

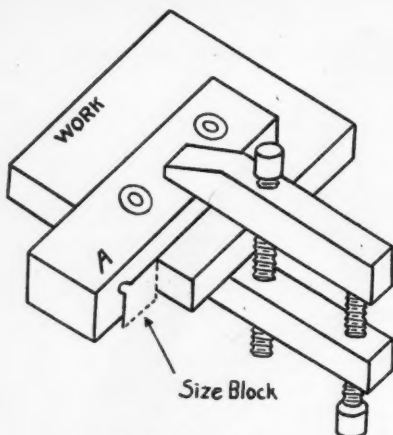
A Twin Disc Close Coupled Clutch, located on the main driving shaft, drives the six revolving work spindles. The driving mechanism does not set up any side strains on the work spindles or turret. "We are using the Twin Disc Clutch because it will take a heavier load," is *one reason* the makers of this lathe, the Baird Machine Co., Bridgeport, Conn., give for replacing the clutch formerly used.

But, in addition to its greater capacity, the Close Coupled Twin Disc Clutch has remarkable all-around adaptability. The extraordinary simplicity and compactness of its design enable the machine tool designer to incorporate it into special installations, thereby combining unusual efficiency with greater economy. Baird designers, in this lathe, required only a special sleeve to suit this clutch to their individual design.

With a size and type for practically every machine tool need—2, 2½, 3, 3½, 4, 4½, 5, 5½, 6, 7, and 9 in. effective diameters; oil or dry plate, single or duplex—the Close Coupled Twin Disc Clutch may effect a considerable saving for you. Write our Engineering Research Dept. for specific recommendations. Engineering Data Book on request. **Twin Disc Clutch Company, 1326 Racine Street, Racine, Wisconsin.**

**TWIN DISC**  
CLUTCHES





Universal Jig Plate.

the use of the device shown at A in the illustration. This device is a jig plate of simple construction, to be used in connection with size blocks or Johansson gage blocks. It is made of tool steel, with two holes accurately bored through it, as shown, and is hardened and ground. A set of bushings may be used with the tool so that holes of different diameters may be laid out or machined with the aid of the tool.

A typical application of the tool may be seen in the drawing at the lower right hand corner of the illustration. A hole in a jig plate is to be bored 0.500 in. from the side and 2.000 in. from the end. As the first hole in the device is 1.000 in. from the shoulder, a 0.500 in. size block is placed between the workpiece and the shoulder, bringing the center of the hole in the device exactly 0.500 in. from the edge of the piece. The width of the device being 1.000 in., micrometer gage blocks are used to set the tool exactly 1.500 in. from the other edge, or 2.000 in. to the center of the hole. The device is then clamped in position and the piece is laid out or drilled, as required. The work can

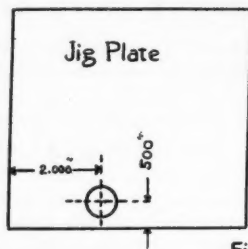
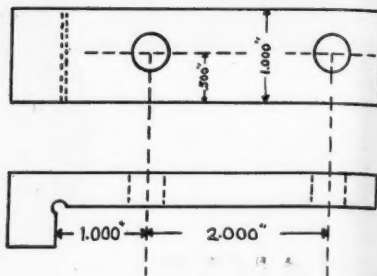


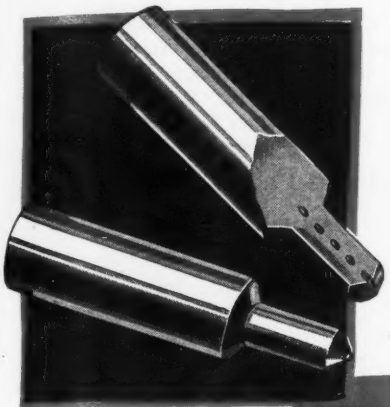
Fig 1.

afterward be bored to the desired size by using a tool with a pilot of the diameter of the drilled hole. In many cases the tool is used to "spot" the hole with a drill of the size of the bushing, then drill the hole with a drill slightly smaller, after which the hole is bored to size or reamed with a tool of the right size, all of which is done with the tool clamped in place.

## A Handy Slotting or Splining Fixture

By AVERY E. GRANVILLE

A SLOTTING or splining fixture of wide application is shown in the illustration herewith. This tool may be used for slotting boring bars or other similar work, splining shafts, or other work of this nature within its capacity. The principle involved may also be applied to large work with a large



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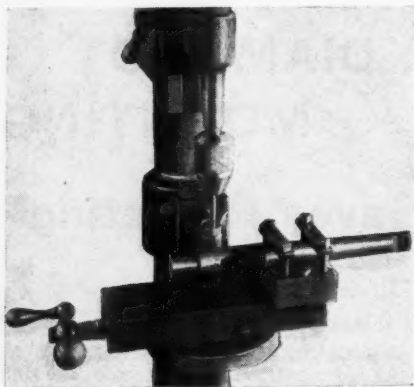
Chicago

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## Multi-Set Diamond Dressers

er fixture and a larger drill press. It is not intended that this equipment should be used on production work where a standard spline miller or key-



Slotting a Boring Bar.

way milling machine is available, but on the many jobs of splining or slotting that occur in the small shop, it can be used to advantage.

The main part of the fixture is the slide, which works on a base that is bolted or clamped to the drill press column or to the machine-table. The slide is operated by means of a ball crank to obtain the feeding movement. The work-holder is merely a V-block bolted to the slide, with two spring-lifted strap clamps to hold the work in process. With a long shaft, some means must be provided to support the outer end.

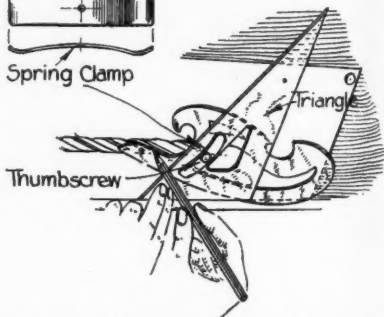
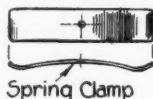
On work such as that shown in the illustration, a long fluted spline cutter is used, since in this case the slot goes entirely through the bar. The slot is first drilled out and then is finished as shown. A slip bushing in a clamping bracket guides the cutter from above, and another bushing steadies the lower end of it. The brackets carrying the guide bushings are fastened to the press column so as to

be easily moved up or down, separately, in order to accommodate work of various diameters. It is best to support the cutter as close to the work as possible.

## Clamp Facilitates Irregular Curve Repetition

By MORRIS A. HALL

SOMETIMES an irregular curve must be duplicated a number of times. Ordinarily such a task is very difficult, if not impossible, but by using a spring clamp and triangle as described here, any shape that can be drawn can be repeated indefinitely. The clamp is of spring brass, 1/32 in. thick and three or four times as wide, bent up slightly at the ends and sprung upward in the center. A small hole is drilled in the center of the spring for the thumb screw, which should be small with a small stem and fine threads similar to the thumb screws of drafting instruments. A



By clamping the curve to a triangle, any curve can be duplicated indefinitely.

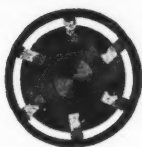
hole is drilled in the triangle of the correct size to allow stock for threads, then when the thumb screw is screwed in, the screw cuts its own threads.

A medium-size triangle is preferable. It will be found necessary to have three holes for the thumb screw

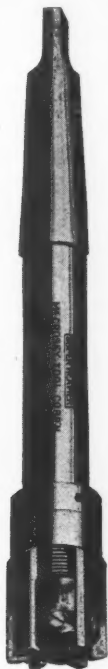




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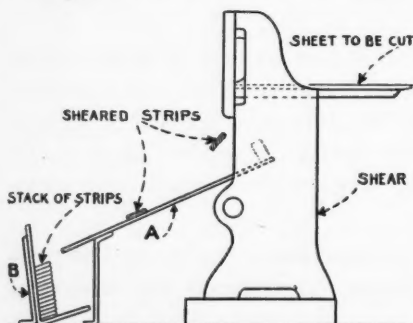
**McCrosky-SUPER Reamers**

in a 30-60 deg. triangle—near the long point and on both sides near the base. Working with triangle and tee square, the curve is moved until the correct position is found, then the curve is clamped to the triangle. To make duplicate curves, the curve and triangle are moved together as a unit, in any direction, the tee square and triangle keeping the curve in perfect alignment. Thus the triangle can be moved to the right or left, and the tee square can be moved upward or downward, always with assurance that the curve will be duplicated exactly.

## Device For Stacking Sheared Strips

By F. W. WINIFRED

**T**HE illustration shows a device that was used successfully to stack strips of sheet metal as they were cut off by a shear. Ordinarily



Device For Stacking Sheared Strips.

the strip falls on the floor, as it is cut off, and must be stacked by hand. By providing the machine with an angular plate bolted at an angle as shown at A, and a rack as shown at B, however, the strips are piled automatically and uniformly.

As each strip is cut off, it falls onto

the plate A, which is inclined at just enough of an angle so that the piece of work will slide down to the rear end and over the edge. If the rack is properly located, the strips will pile themselves as shown. Before applying this attachment, the services of two men were required on this operation. The operation is now handled by one operator, who turns out approximately the same amount of production in the same length of time.

## Glycerine—a Promising Quenching Medium

By K. A. OLDACRE

**F**OR many types of steel and classes of work the tool maker and steel treater often wish for a quenching medium that comes in between the two extremes of oil on the one hand and water on the other. For those wanting a "happy medium," glycerine offers a good many advantages, and without the complications and drawbacks which accompany so many of the other quenching mediums which have been developed.

By mixing glycerine with water in various proportions, it is possible to obtain almost any result between the use of water and oil. This fact is worth remembering for those requiring to vary the quenching power of the bath. The mixture found most useful will be about 50 to 75 per cent of glycerine and the balance, water.

One real advantage over other quenching mediums is that glycerine has no chemical action upon the metal being quenched. It does not give off any objectionable fumes, so that the matter of ventilation is not involved. As it is neither inflammable nor explosive, there is no fire hazard.

There are certain things to be remembered, however, and failure to bear these in mind may cause diffi-

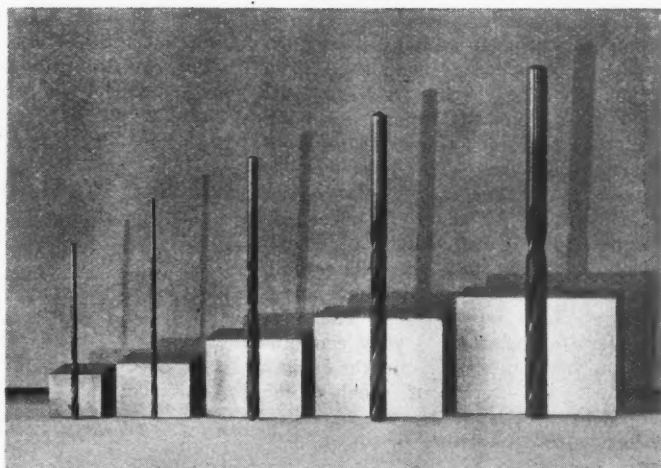
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culty. The greatest drawback to glycerine is, probably, that it is expensive. On the other hand, once the glycerine is put into service, the most important thing to remember is that it is hygroscopic. Consequently, the proportion of glycerine to water will not remain constant unless provision is made to protect the mixture from external moisture. The best way to watch the mixture is to use a hydrometer, adding glycerine as necessary for the excess water taken up. When this is done, the mixture will remain constant and the quenching power constant and dependable. The glycerine-water mixture is very economical and convenient for certain classes of work and types of steel which come in between those requiring either water quenching or oil quenching.

### What Are Accurate Costs?

(Continued from page 32)

program for the sole purpose of teaching those concerned the necessity for correctly charging every item of labor—however small.

Probably the outstanding reason for laxity in this respect is lack of incentive to arrive at worth-while information. In other words, cost departments have often been content to present figures which were little better than estimates simply because it was, as a rule, impractical to "check and double check" their figures.

Nowadays, however, when cost reduction is assuming the role of a definite function of management, cost finding becomes a feature of vital significance. Slipshod methods can no longer be tolerated. An inaccurate cost quotation is far worse than no quotation at all!

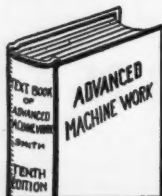
### Melting Points of Substances

Fahrenheit scale is used.

Mercury .....	—39
Turpentine .....	14
Ice .....	32
Tallow .....	92
Phosphorus .....	112
Stearine .....	109 to 120
Potassium .....	136 to 144
Wax .....	142 to 154
Sodium .....	194 to 208
Alloy, 3 lead, 2 tin, 5 bismuth ..	199
Iodine .....	225
Sulphur .....	239
Alloy, 1½ tin, 1 lead .....	334
Alloy, 1 tin, 1 lead .....	370 to 466
Tin .....	442 to 446
Cadmium .....	442
Bismuth .....	504 to 507
Lead .....	608 to 618*
Zinc .....	680 to 779*
Antimony .....	810 to 1150
Aluminum .....	1157*
Magnesium .....	1200
Bronze .....	1692
Silver .....	1733* to 1873
Gold .....	1913* to 2282
Copper .....	1929* to 1996
Cast iron, white .....	1922 to 2075*
Cast iron, gray .....	2012 to 2786
Steel .....	2372 to 2532*
Steel, hard .....	2570*; mild, 2687*
Wrought Iron .....	2732 to 2912
Platinum .....	3227*

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For Apprentices, Machinists, Foremen and Toolmakers; Technical, Trade, Automobile and Apprentice Schools, and Machine Shops, Universities and Colleges.

New Section 16 treats on Tungsten Carbide Cutting Tools

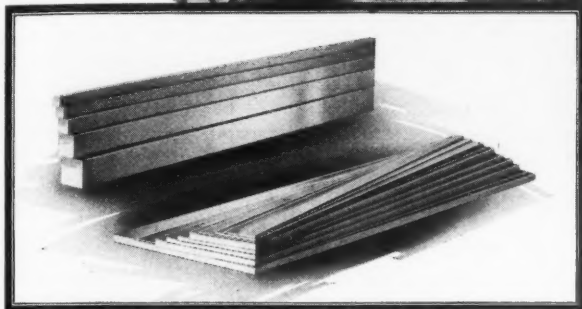
The Master Book for the machine shop man.

INDUSTRIAL EDUCATION BOOK COMPANY, Box 153, Back Bay, BOSTON, MASS.

April, 1931

Modern Machine Shop 61

## You can save time on many a job



## with Starrett Ground Flat Stock

Consider the conveniences of having in your tool-crib a stock of the finest tool steel in just the sizes and thicknesses you need for making your dies and jigs and special tools! Not only the convenience, but also the *economy*!

Instead of wasting hours, finding an old piece of steel *about the right size* and grinding it to the thickness you want, you simply pick out a suitable piece of Star-

rett Ground Flat Stock and go right ahead with the job.

Starrett Ground Flat Stock No. 495 comes in 18" lengths. Thicknesses range from 1/64" to 1". Widths range from 1" to 6". It will save time and money in all shops which make test tools, dies, jigs, fixtures, parallels, shims, special gages, templates, stamps and cutters. Write for Starrett Catalog 25 "MD," which gives sizes and prices.

THE L. S. STARRETT CO.

World's Greatest Toolmakers  
Manufacturers of Hacksaws Unexcelled  
Steel Tapes—Standard for Accuracy  
Athol, Mass., U. S. A.



# Use Starrett Tools

## Over the Editor's Desk

### Character First

**I**N spite of set-backs like the period we have just passed through, it is evident that the world is progressing. For instance, employers are placing more importance upon character and less upon the ability of the individual to perform a given task without preliminary instruction. Trained men are necessary for certain tasks, but the day when each man hired must be experienced in the work he is to do is passing, as is also the mistaken idea that no time must be spent in training others besides apprentice boys.

It is far more sensible to spend a little time and effort in showing a green but earnest worker how to operate the levers and gadgets on a machine with which he is unfamiliar than it is to insist upon having an operator who may be familiar with the machine but who may not be nearly as desirable an employee. And it is much more sensible to train the steady, loyal workman for a new task when the old one is discontinued than it is to lay off the workman and hire another—as has been done thousands of times in the past. It will cost as much, and possibly more, to make the change as to train the old employee.

Several large plants have adopted the system of putting each new employee, regardless of previous experience, through a training department where he is made familiar with the work he is expected to do. In one plant each new man is trained to perform half a dozen tasks, so that he will be available for each of the several tasks when required. Another plant has a "preferred group," each member of which is trained for a

number of jobs. This group makes possible the proper balancing of production and eliminates the necessity of hiring additional operators to take care of rush orders. The men in this group are of higher caliber than the majority of the operators, and it is from this group that men are selected for supervisory positions.

Through the adoption of a policy of making every effort to keep the workers who had records of loyalty and steadiness, another company reduced its rate of turnover, during a seven-year period, from 47 per cent to 21 per cent. In changing the workers about from one job to another, it was found that the average worker of 40 years of age is as adaptable to change as the younger one, and is much more stable and dependable.

### Business

**A**LTHOUGH the total volume of business is still relatively small, commercial and industrial activity is steadily increasing. Steel mill operations are slowly but surely expanding, and the mills are now producing at 57 per cent of capacity as compared with 55 per cent a week ago. At the first of this year steel mill production was down to 30 per cent.

Automobile production, which will undoubtedly be the greatest factor in the recovery of business, continues to increase. Production during the first week in March amounted to 58,750 cars, as compared with 54,020 cars during the preceding week. Freight car loadings increased from 682,000 cars during the last week of February to 724,000 cars during the first week of March.

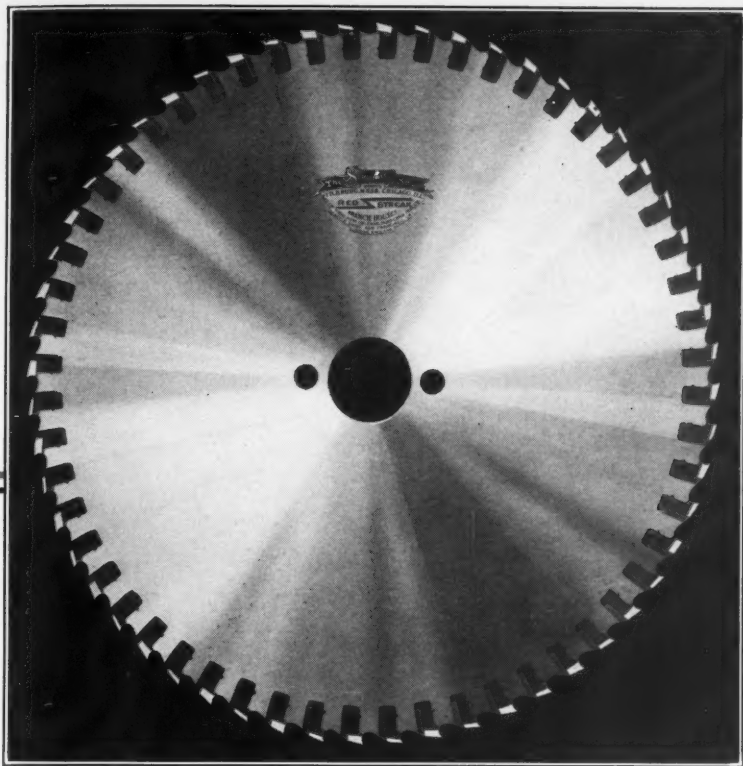
It won't be long now!



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## and now Texas Votes For RED STREAK Metal Saws

A Red Streak Inserted Tooth Metal Saw, like the one illustrated above, has been in operation for many months in a well known plant in Huston, Texas. This saw is used for cutting stock in the manufacture of roller bits. With its sturdy plate of high grade steel, scientific curved gullets and teeth of high speed steel this Red Streak Saw bites through toughest metal in its daily task.

*Ask Simonds engineers to recommend a saw  
that will give you as satisfactory service.*

### SIMONDS SAW and STEEL CO.

"The Saw Makers"

Established 1832

Fitchburg, Mass.



# Aircraft Industry on "RED STAR"

In one of the most exacting  
requirements of airplanes — SIMONDS  
is extensively used. RED STAR  
with the brilliant RED BACK  
blades of high quality —  
are specified because they  
show no breakage to speak of.  
Time and cost are considered.

THE BLADE  
WITH THE  
**RED BACK**  
HIGH SPEED STEEL  
FOR HAND  
USE

**SIMONDS**  
U.S.A.

The  
Trade



THE BLADES  
WITH THE  
**RED END**  
TUNGSTEN STEEL  
FOR  
HAND OR POWER

# usty Concentrates D STREAK" Hack Saws

the most exacting industries — the manufact-  
ures — SIMONDS HACK SAWS are exten-  
REDSTREAK the High Speed Steel Blade  
lliant RED BACK EDGE and tungsten steel  
h quality — "the Blade with the RED END"  
because they cut straight and accurate with  
to speak of. They save a lot of money when  
st are considered.

The illustration on this page shows  
a "RED STREAK" High Speed  
Steel Blade at work in a factory of  
the Sikorsky Aviation Corporation,  
one of the foremost aircraft manu-  
facturers.

*Buy from your Dealer.*

# SIMONDS

## The HACK SAWS

### Trade Marked in RED

The new Simonds windowless fac-  
tory will have automatic humidity  
control which will keep the air at a  
beneficial level at all times. Every  
ten minutes, a half-million cubic feet  
of air, washed and filtered, will be  
brought into the building.

\* \* \*

Twenty-five years ago the Simonds  
business became interested in Canada,  
under the firm name, Simonds Can-  
ada Saw Co., Ltd. They now operate  
a large factory in Montreal and in  
addition modern service stations at  
Toronto, Ont., St. John, N. B., and  
Vancouver, B. C.

\* \* \*

The roof of the new windowless fac-  
tory which is being built by the  
Simonds Saw and Steel Co. at Fitch-  
burg, Mass., covers approximately  
200,000 square feet, is supported by a  
welded structural steel frame, which  
to some extent is made necessary by  
a desire to reduce the number of  
interior columns to a minimum.

\* \* \*

A special noise insulating material  
(a wood product) is laid in layers  
with waterproofing compound in such  
a way that the roof kills the noises  
and vibration, instead of acting as a  
giant sounding-board. At the same  
time it insulates the interior of the  
plant against heat and cold from the  
outside.

\* \* \*

Cutting a railroad spike in two with  
a wood cutting circular saw is quite  
a task. The other day a man wrote  
us about doing this accidentally. He  
sent us the spike as proof and said,  
the saw, a Simonds, had been doing  
good work for 15 years. After cutting  
the spike he touched up the teeth and  
kept on sawing.

\* \* \*

The nation's foremost color authori-  
ties have been consulted in an effort  
to obtain for the interior of the  
Simonds plant the exact colors to pro-  
mote ideal working conditions. It is  
a recognized fact that certain colors  
stimulate workers and help keep  
them in a cheerful frame of mind.  
To illustrate — machinery in the  
Simonds Windowless plant will be  
painted orange-yellow to increase vis-  
ibility and thereby aid in accident  
prevention.

# GOOD FILES CUT FAST DO NOT SCRAPE

## SIMONDS The File That Lasts Longer

Buy From  
Your  
Dealer



Tougher, edge-holding steel, and perfect, sharp teeth that bite hard and remove more metal at each stroke, are reasons why

SIMONDS FILES give metal-working shops more service for their money. If you haven't used these files ask your tool buyer to get a few - - - Try them out yourself.

**SIMONDS SAW and STEEL CO.**  
Established 1832 Fitchburg, Mass.

# SIMONDS FILES



## Simonds Ground Flat Stock For Many Uses In Machine Shops

For die makers and mechanics, who want to save money, *Simonds Ground Flat Stock* is the most efficient steel on the market. It is used for making gauges, jigs, templates and many other tools that require perfect material and workmanship. This stock comes uniformly annealed, cut to proper lengths and is ground to width and thickness.

Order *Simonds ground flat stock*  
**SIMONDS SAW and STEEL CO.**

## NEW WAPPAT DRILL Has Outstanding Qualities



Now you can get an electric drill of outstanding quality — a drill that combines ruggedness with adaptability to many different kinds of work, satisfactory performance and longer drill life are assured facts with WAPPAT DRILLS.

For further information write

**WAPPAT INC.**

7525 Meade St.

Pittsburgh, Pa.

## New Shop Equipment

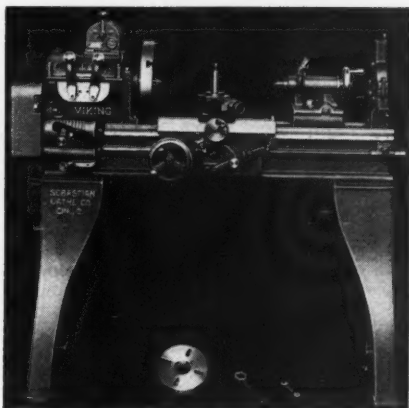
### "Viking" Line of Lathes Announced by Sebastian

A line of geared head motor-driven engine lathes in 12-in., 16-in., and 20-in. sizes, to be known as the "Viking" line, has been announced by The Sebastian Lathe Company, 1 Culvert Street, Cincinnati, Ohio. The lathe is designed for accuracy and simplicity of operation, and is of rugged construction. Among the outstanding features are the eight spindle speeds, silent chain motor drive, reverse in the apron, and a wide thread-cutting range.

The 12-in. lathe, shown in the illustration, has a 4-ft. nickel steel bed and is 22½ in. between centers. Beds can be supplied in 3, 4, 5, 6, and 8-ft. lengths. Eight speeds are available through the geared headstock, from 26 to 620 r. p. m. All gears are of steel, and are oversize to provide the maximum of strength. A 1½ in. hole extends through the spindle, allowing a collet capacity of ¾ in. Centers are Morse No. 2 Taper. The swing over the bed is 12½ in., and the swing over the carriage is 8¾ in. The front bearings are 2½ in. x 2¼ in. and the rear bearings are 1½ x 2¼ in.

The carriage is 16 in. wide and has a full hand-scraped bearing. The compound rest is graduated, and the cross feed collar and compound rest collar, which are of the friction type, are also graduated. The compound rest travels 2 in. The leadscrew, which is made from a master P & W tested screw, is ½ in. diameter with 6 threads per in. From 6 to 96 threads per in. can be cut. A full quick change gear box is pro-

vided, making it possible to obtain any thread or feed without the use of loose gears. A tumbler reverse plate provides for cutting left-hand threads. Power cross feed is provided, with reverse gears in the apron. The entire mechanism is protected by a safety shear pin, making it impossible for students or inexperienced operators to damage the machine.



"Viking" 12-Inch Engine Lathe.

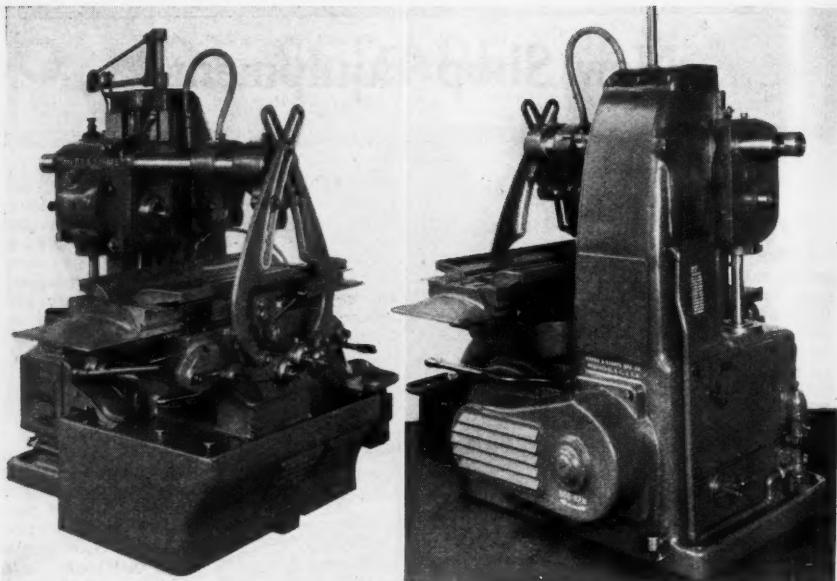
The tailstock is graduated to facilitate setting for taper cutting, and a tailstock center oiler is included. A bronze tailstock spindle lock of patented construction replaces the usual split tailstock. The diameter of the tailstock spindle is 1¼ in.

A ¾-h.p. 60 cycle, 3 phase, 220 volt motor is used, operating at 1800 r.p.m. The speed of the drive shaft is 500 r.p.m. The motor is fitted in the rear, making a compact, self-contained unit.

All gears are completely enclosed for safety. Alignment is accurate within 0.001 in. The spindle nose is 2½ in. diameter, with 8 threads per in.

### B & S No. 22 Plain Milling Machine

The Brown & Sharpe Manufacturing Co., Providence, R. I., has announced the addition of a No. 22 Plain Milling Machine to its line of milling equipment. The No. 22 machine is of entirely new design and is intended for manufacturing, possessing some completely new features which are said to adapt it equally well to short as well as long run production jobs. The machine has an automatic longitudinal feed of 22 in.,



Front and Rear Views of B & S No. 22 Plain Milling Machine.

a transverse adjustment of saddle of 6 in., and a vertical adjustment of the spindle head of 13 in.

Probably the most important feature of the machine is the complete control of all operating functions from the front, making it unnecessary for the operator to leave his operating position. All speed changes, feed changes, hand longitudinal adjustment of the table, transverse adjustment of the saddle, and vertical adjustment of the spindle head are obtained by the movement of a single lever. The spindle head is also clamped rigidly in position by a single lever that is easily accessible from operating position.

Seven cycles of automatic table operation are available with the dogs furnished, and power fast travel and cutting feed are available in both directions. Hand control, through a single lever, is also provided. The spindle is mounted on four anti-friction bearings and can be set to operate either right or left hand. The speed and feed change system used on the B & S "Standard" milling machines is incorporated in this machine, a single lever for each providing a change in speed or feed with a turn in either direction.

Sixteen spindle speeds ranging in practically geometric progression from 25 to 620 r.p.m., and 16 feed changes from 1 in. to  $38\frac{1}{2}$  in. per min. are available. Direct-reading dials above the levers indicate the speed or feed for which the machine is set. Feed changes are made by a lever on the left of the saddle; speed changes by a lever on the right. When used on dialing operations, where frequent adjustments of table, saddle, and spindle head are required, the speed and ease of making these adjustments is augmented by large-diameter graduated dials for all three movements, permitting an unusually high degree of accuracy.

The machine is of the unit assembly type of construction. All gears and shafts are of heat-treated alloy steel. Short rugged splined driving shafts are used in the unit assemblies.

Furnished as extras, when desired, are the No. 22 vertical milling attachment, vertical milling attachment crane, and the fixture flushing pump. A pad is provided on the back of the machine to which the vertical attachment can be fastened when not in use. The crane provides a convenient means of trans-



THE STEEL WE USE  
**DISC-INSPECTED**  
BY CARPENTER'S RESEARCH DEPARTMENT  
THE CARPENTER STEEL CO. READING, PA.



## "GRINDING CHECKS"

*Don't Worry Me!"*

... says Sam  
of the Tool Room

And after all, why should they  
—because Sam uses a  
TOUGH Tool Steel . . .

. . . and a TOUGH Tool  
Steel won't check as easily as  
a BRITTLE Tool Steel.

You can prove this to your own satisfaction by  
making a very simple test.

Bulletin "C-1," prepared by Carpenter's Research  
Department will tell you how to do it and show  
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and the effect that both have upon your tools.

Write for a copy of this new Bulletin "C-1" today. It will save time  
and money in your shop and is free to any shop man or executive.



## THE CARPENTER STEEL COMPANY

*Mills and Main Warehouses: READING, PA.*

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1516 Carroll Ave.

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3284 Main St.

**ST. LOUIS**  
4063 Forest Park Ave.

**PHILADELPHIA**, Horace T. Potts & Co., East Erie Ave. and D St.

ferring the attachment to the face of the spindle head. The fixture flushing pump is used to flush chips from the fixture and table. Coolant is available at all times when the machine is running.

### 64A-Type Fellows Gear Shapers

The Fellows Gear Shaper Company, Springfield, Vermont, has placed on the market a new line of gear shapers known as the 64A-type and bearing the following designating numbers: 64-A, 624-A, 624A-3, 625A, and 645A-3. These machines, fundamentally, are of the same construction as the standard 6A and 6A-3 types, with the exception that a new apron of more massive design to accommodate a large work spindle is used so that gears integral with shanks can be cut. The work spindle shown in Fig. 2 has a large straight hole  $5\frac{1}{8}$  inches in diameter passing completely through it. This work-spindle can be

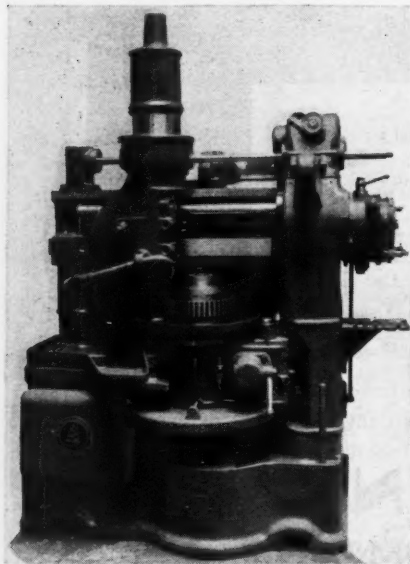


Fig. 1—Front view of Fellows 64A type Gear Shaper with 5 in. stroke saddle and new type apron.

arranged with sleeves to hold shank gears having a maximum shaft diameter of 5 in. or with an adapter to fit standard reverse taper work arbors.

Some of the new features, in addition to the new apron, incorporated in these machines are: A hardened and ground plate on the base for the apron

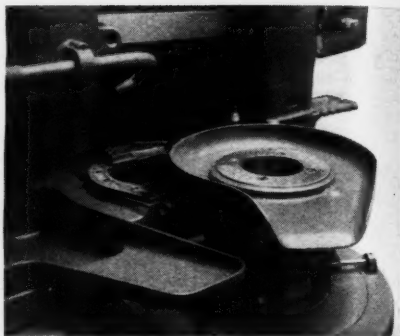


Fig. 2—Close view showing new apron design, large work-spindle, and pressure grease cup lubrication.

bearing; grease pressure cup lubrication for apron, work-spindle, apron bearing angle block and apron pivots.

The capacities of Nos. 64A, 624A are: 18 in. external and internal spur gears, 5 in. face external, 3 in. face internal. The 64A is adapted to the use of both 3 and 4 in. pitch diameter cutters with  $1\frac{1}{4}$  in. hole, whereas the 624A can only use 4 in. cutters with  $1\frac{1}{4}$  in. hole. The capacities of No. 645-A are the same as for Nos. 64A and 624A, with the exception that this machine is adapted to the cutting of helical and herringbone gears in addition to spur gears. Helical cutters used on this machine are  $3\frac{1}{2}$  in. pitch diameter,  $1\frac{1}{4}$  in. hole, and spur cutters 4 in. pitch diameter with  $1\frac{1}{4}$  in. hole.

Nos. 624A-3 and 645A-3 have the same capacities as the other machines as far as diameter is concerned, but are limited to the cutting of gears having a maximum face width of 3 in. The 624A-3 is adapted to the cutting of spur gears only, whereas the 645A-3 will cut spur, helical, and herringbone gears. Maximum pitch for spur gears is  $\frac{3}{4}$  diametral, and  $5/7$  diametral pitch for helical gears. The 64A-types with the 3 in. maximum face width capacity are especially recommended for heavy-duty production work, as they are supplied with a one-piece cutter-spindle and saddle of exceptionally rigid design.

# INTRODUCING THE DUMORE MIDGET

HERE is one of the most useful tools the Dumore Company has ever developed. Built to DUMORE standards, it will grind to the finest limits. Its small size and light weight make it one of the simplest grinders to set up and operate, and it now provides a precision grinder for practically every make of bench lathe, including Hardinge Bros., Stark Tool Co., Porter-Cable, Rivett, South Bend, Potter, Pratt & Whitney, Hjorth, and equipment of this type.

## Offhand Grinding

For offhand grinding, it is particularly adapted to the finishing of small openings, radii, and irregular shapes in all kinds and types of dies. Correcting inaccuracies in blanking dies, providing top rake of a form tool, sharpening dinking dies, button dies, etc., are only a few of the Midget's many uses.

## Cylindrical Grinding

The tool post shank provides a solid mounting for lathes, milling machines or other machine tool set-ups for internal and external grinding operations, relocating centers, face plate grinding, grinding of small openings, tapers, centers, etc. The motor is adjustable on the tool post shank for different centers.

## Drilling and Miscellaneous Operations

High speed drilling operations in wood and molded material, operating high speed slitting saws, in undercutting

microns in commutators, and spark testing of steel, are a few of the Midget's various uses. For hand operation, a special wood handle which slips over the tool post shank, is provided.

## Special Design of Collet

An ingenious design of chuck collet permits the use of round shanks ranging from  $\frac{1}{8}$ " to  $\frac{1}{2}$ " in size. This chuck will accommodate drills from No. 42 to No. 22 inclusive. The collet is attached directly to the armature shaft so that the power of the motor is transmitted direct to the grinding wheel without the use of a drive belt.



The motor switch is conveniently located in the motor case and the unit is provided with 8 ft. rubber covered cord and molded rubber attachment plug.

## Specifications

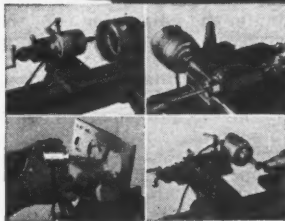
**MOTOR**—1/20 H. P. universal type.  
**SPEED**—Maximum, 20,000 R. P. M.  
Full load speed, 10,000 R. P. M.  
**CURRENT CONSUMPTION**—95 watts.

**ARMATURE CORE**— $1\frac{1}{2}$ " x  $\frac{1}{2}$ "  
High grade selected ball bearings.  
**SIZE OF SHANK**— $\frac{1}{8}$ " x  $\frac{1}{2}$ ". Motor is adjustable on shank for different centers. Specially designed collet chuck, capable of taking round shanks  $\frac{1}{8}$ " to  $\frac{1}{2}$ " in size. Switch mounted in motor case.

## Equipment

Six wheels —  $1 \times \frac{1}{8}$ ",  $\frac{3}{4} \times \frac{1}{8}$ ",  $\frac{1}{2} \times \frac{1}{8}$ ",  $\frac{1}{4} \times \frac{1}{8}$ ",  $\frac{1}{8} \times \frac{1}{8}$ ",  $\frac{1}{16} \times \frac{1}{8}$ ".  
Shank  $1\frac{1}{2} \times \frac{1}{2}$ " diameter. No. 60 Grit, No. 0 Grade. Wooden handle with mounting screw. Two wrenches, can of oil, 8 ft. rubber covered cord and molded rubber attachment plug. Grinder packed in wooden box with sliding cover.

## A MULTITUDE OF USES



# THE DUMORE MIDGET

Send the coupon  
or write for  
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information.

THE DUMORE COMPANY  
26 Sixteenth St. Racine, Wis.

Please send complete information  
on the new Dumore Midget.

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City \_\_\_\_\_ State \_\_\_\_\_

## Automatic Sizing For Centerless Grinding

Through the use of automatic sizing devices, it is now possible to grind cylindrical work on Cincinnati Centerless Grinders without the necessity of fre-

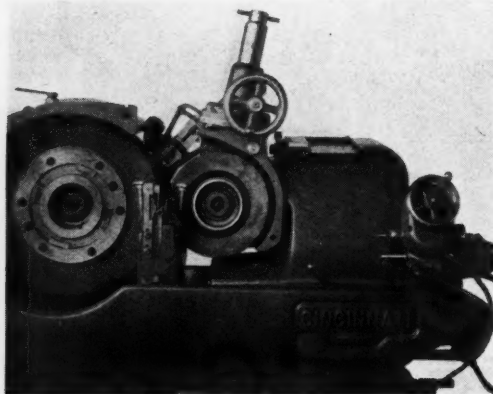


Fig. 1—Automatic Sizing Device Mounted on Cincinnati No. 2 Centerless Grinder.

quently checking the parts for accuracy or adjusting the feed wheel slide. What was formerly the task of the operator is now the job of the machine.

In the centerless method of grinding, the throat dimension between the grinding wheel and feed wheel determines the size of the piece being ground. As the wheels wear, the grinding throat becomes larger and accordingly the diameter of the work increases. The automatic sizing device advances the feed wheel in such a way as to maintain the throat dimension within very close limits.

The actual mechanism developed by Cincinnati Grinders Incorporated, Cincinnati, Ohio, for keeping the work properly sized is relatively simple. As illustrated in Figure 1, an electric contact gage is mounted on the rear of the work fixture. A closely-adjusted gauging member is arranged so that as the diameter of the work increases, due to wearing down of the grinding wheel, and is carried along a considerable arc, this gauging member contacts with the work movement. By means of a small mercury switch mounted close to the pivot end of the gauging member, electric contact is made. The gauging mem-

ber can be so adjusted that an increase in diameter of 0.0001 in. on the work will cause the electric contact to be made.

The electric contact energizes a solenoid connecting a valve on the feed mechanism (shown in Figure 2) which, by hydraulic means, operates the infeed slide screw. Provision is made by means of a ratchet and pawl adjustment connected to the worm shaft to operate the feed slide nut, so that an infeed movement of the slide as fine as 0.0001 in. may be obtained.

An adjustable needle valve on the exhaust port is set to delay the return of the feed piston the necessary interval so as to permit the work which has been ground during this adjustment to pass between the gage contacts. If the work is still large, the feed will operate again. However, if correct size is restored, the gauging member will return to normal position and contact will be broken, no further action of the feed mechanism taking place. All back lash on the feed screw is eliminated by means of a hydraulic cylinder attached to the machine bed.

This automatic sizing mechanism is available for standard Cincinnati No. 2

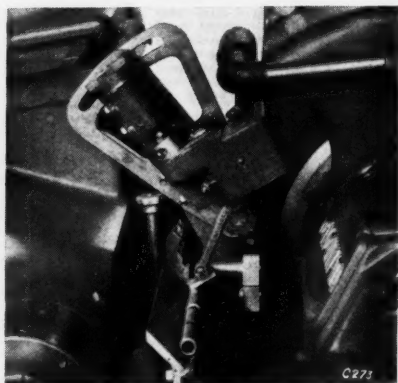
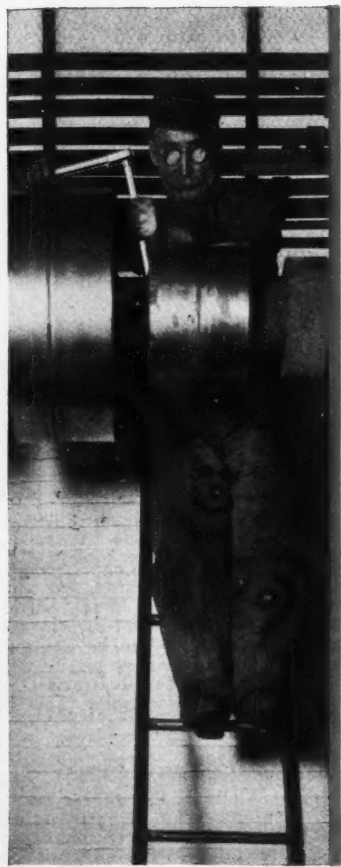


Fig. 2—View Showing Feed Mechanism by Which Infeed Slide Screw Is Operated.

Centerless Grinders. It is constructed so that adjustments can be made for any angularity of blade and varying diameters of work. If desired, the gage may be made inoperative or entirely removed from the grinder. By automa-



# “WHERE’S YOUR SOCKETS?”

WHEN cramped quarters and awkward places make *the goin’* tough — that’s the job that will sell you on Williams’ “Supersockets.”

Industry is awakening to the thousand advantages of the “Supersocket” system, with its extreme flexibility and endless combinations of Handles, Extensions and parts. “Supersockets” enable the mechanic to do a better job in less time. They will “get in” and work where no other type of wrench could possibly be used.

Williams’ “Supersocket” wrenches are made in five different patterns, covering every industrial requirement. Ask your Supply House.

J. H. WILLIAMS & CO.  
“The Wrench People”  
75 Spring St., New York

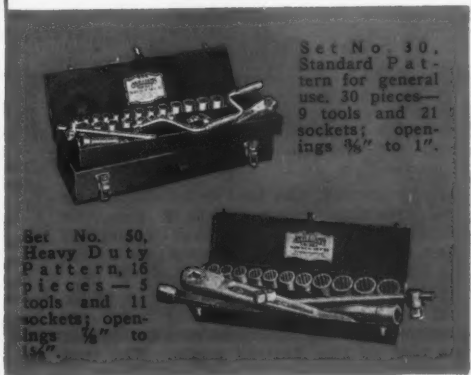
Western Warehouse:  
Sales Office, Chicago

Works:  
Buffalo, N. Y.

An actual example of “Supersocket” efficiency. With a any other type wrench, several pulleys would have to be loosened and slid over on the shaft in order to tighten this one slipping pulley. With a “Supersocket” combination it takes two minutes instead of one or two hours.

Buy From Your Distributor

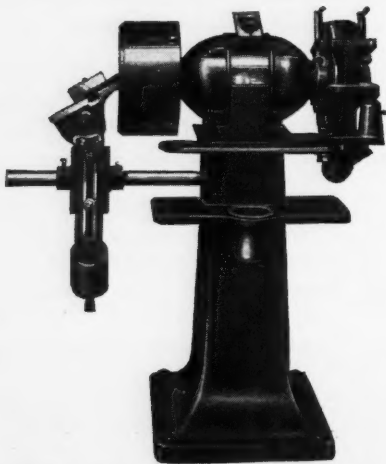
**WILLIAMS**  
SUPERIOR DROP-FORGED TOOLS  
“SUPERSOCKET”  
WRENCHES



ically sizing work during the roughing and semi-finishing grinding operations, a uniform stock removal on the finishing operations is obtained, thus insuring closer limits of accuracy.

## U. S. Tungsten Carbide Tool Grinder

A grinder especially designed for the sharpening of Carboloy, Ramet, Widia, and other tools of similar composition has been developed by The United States Electrical Tool Company, 2471 West Sixth Street, Cincinnati, Ohio. The outstanding feature of the machine is the tool rest, which comprises an adjustable table and a sliding guide which together hold the tool securely at any angle against the cup wheel. This construction is said to prevent the mechanic from grinding away any more of the tool than is absolutely necessary to sharpen—an important item when the cost of the tool is considered. It is also



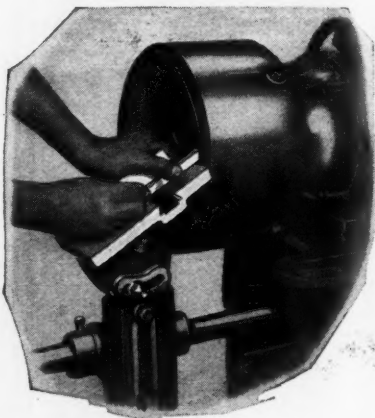
"U. S." Tungsten Carbide Tool Grinder.

said to prevent the tool from chattering and breaking away when in use. In addition, it is claimed that a perfect edge is automatically assured, thus aiding the production of better work.

The finished face on the side of the tool rest at point of cramping is graduated so that the operator can easily set the rest to any desired angle. The tool

rest is also adjustable for height and for wheel wear.

The machine is powered by a 2 h.p.



The tool rest is graduated to aid in setting to the desired angle.

ball bearing motor of 1,750 r.p.m., which will be furnished for any standard voltage, either A.C. or D.C. Push button control is provided, as well as a boiler plate wheel guard that can be adjusted for wheel wear. The grinder can be furnished as shown in the illustration, or with cup wheel and swinging table at both ends.

## "B-C" Indicator Finger

The Barber-Colman Company, Rockford, Ill., announces an attachment for use with dial indicators, to be called the "indicator finger," designed to aid in the use of the indicator in places that are inaccessible with the ordinary indicator. The finger is clamped to the case barrel surrounding the indicator plunger, as shown in the illustration, so that the curved end of the bell crank rests against the end of the plunger. Thus any movement of the ball end of the bell crank is transferred accurately to the indicator. The finger can be attached or removed easily and quickly.

The frame of the finger is a steel forging and the bell crank is a tool steel stamping. The bell crank has a stop lug so that it will not drop below a normal working position. Machining and assembly operations on the unit are carefully performed so that the quality of the finger will be in keeping with the





Operator simply screws gear into chuck, with wrench, against chuck body. Continued turning rotates chuck members, locating gear accurately in relation to pitch line of teeth, and holds gear securely for grinding or other operation. Chucking time, 4-6 seconds.

Garrison-made chucks for helicals; Sykes and built-up herringbones; spurs, bevels, worms, worm-wheels, sprockets, or for any part having teeth or threads. They can be used for grinding, diamond and single-point boring, reaming, re-machining, etc.

## Garrison-made Gear Chucks are unexcelled for reliability, accuracy, speed and simplicity

**C**HUCKS for any type gear can be purchased for less than make-shift equipment can be designed and built. Garrison-made Gear Chucks eliminate "rejects." They increase the production of each machine and operator, and lower production costs.

Garrison is the only exclusive manufacturer of gear chucks, and Garrison-made patented Chucks have for many years been acknowledged superior from the standpoint of reliability and long-lived accuracy under hard use. They are less expensive in first cost and upkeep—due to volume of business, standardization and simplicity of design.

Garrison maintains a consulting engineering service which is available to any manufacturer or user of gears. Simply mail the coupon or write.

Garrison maintains a commercial grinding department, for the grinding of spur gear teeth—enabling gear manufacturers to obtain the ultimate in silence and smooth power transmission through gears without making expensive engineering and tooling changes, and at no increase in cost. All gears are ground to the tolerances of airplane, machine tool, transmission and motor car manufacturers. Complete equipment permits grinding work on a production basis and at low cost.

GARRISON MACHINE WORKS, Inc., Dayton, Ohio

# GARRISON

# GEAR

# CHUCKS

Tell us more about:

( ) Garrison-made Gear Chucks.

( ) Your spur tooth grinding service.

Firm Name.....

Address.....

By..... Title.....

quality and accuracy of the indicator upon which it is to be used. The unit is finished all over with a dull black

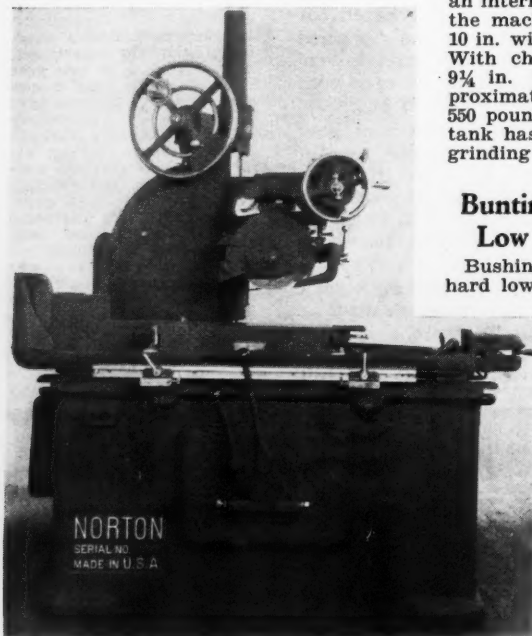


Barber-Colman Indicator Finger.

finish except for the ball point, which is polished. The clamping hole in the frame is made to fit a  $\frac{3}{8}$ -in. diameter barrel.

### Norton Hydraulic Surface Grinder

A Hydraulic surface Grinding Machine of 10 x 12 x 24 in. size is an-



Norton Hydraulic Surface Grinder.

nounced by Norton Company, Worcester, Massachusetts. It has sufficient and well-distributed weight to handle a wide range of work, and is intended for both general tool room and production work. The cutting is done by the periphery of the wheel, producing a straight-line velvet finish. The controls are closely grouped for convenience in operation. Centralized lubrication has been installed for all of the important bearings. The design shows a reduction in the number of parts usually used for this type of machine and very low maintenance costs are anticipated.

The machine is driven by a single  $7\frac{1}{2}$  h.p. 1200 r.p.m. motor of standard frame, mounted in the base. The table is reciprocated hydraulically, and the action is smooth and speedy. The wheel feed is hand-controlled, with an index graduated for 0.00025 in. Wheel traverse is also hand-operated, with one speed for grinding and another for truing.

Hydraulic wheel traverse is also available on special order. The wheel spindle is mounted on ball bearings and is found especially desirable on work with an interrupted surface. The capacity of the machine without magnetic chuck is 10 in. wide by 12 in. high by 24 in. long. With chuck, the height is reduced to  $9\frac{1}{4}$  in. The floor space required is approximately 5 x 8 ft. The weight is 550 pounds net. The grinding lubricant tank has a capacity of 50 gallons. The grinding wheel is 10 x  $1\frac{1}{2}$  x 3 in.

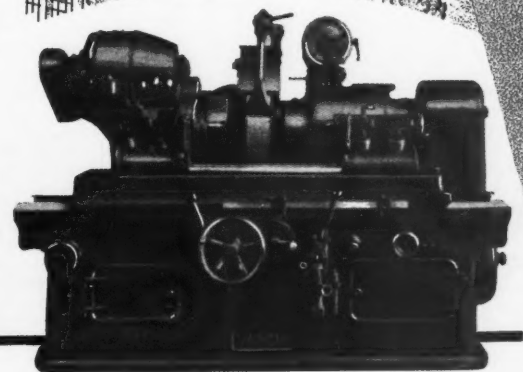
### Bunting Develops Super-Hard Low Friction Bronze Alloys

Bushings and bearings of new super-hard low friction bronze alloys are announced by The Bunting Brass & Bronze Company, 715 Spencer Street, Toledo, Ohio. This product is said to meet the needs of the industry for a bearing metal that has the hardness and ability to withstand pounding, together with low friction and minimum wear. It is especially recommended for mechanical applications where the bearings are subjected to shock loads, high speeds, and other severe operating conditions. The metal is a leaded phosphor bronze alloy, in which the lead content can be varied from 5 per cent to 25 per

# LANDIS TYPE B PLAIN HYDRAULIC GRINDERS

*—built  
for rapid  
Production ~  
Economically*

**RUGGED  
SMOOTH  
POWERFUL**



All that is modern in grinding machine design. A high-production unit used with standard equipment and with special attachments in the leading industrial plants.

An Economical small-lot machine for the small or medium-size plant.

Available in many swings—in a great variety of lengths.

**LANDIS TOOL COMPANY**  
WAYNESBORO PENNSYLVANIA

DETROIT

CHICAGO



NEWARK

PHILADELPHIA

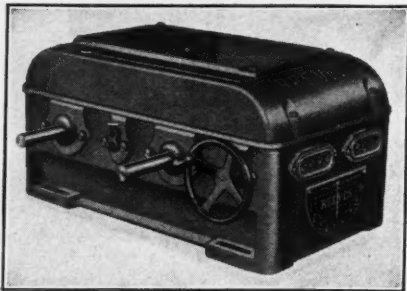
cent, depending on the type of service required.

### Reeves Enclosed Variable Speed Transmission

The Reeves Pulley Company, Columbus, Ind., has augmented its line of variable speed transmissions by the addition of a transmission of the standard Reeves design with the exception that it is totally enclosed in a compact, symmetrical iron case. The enclosure meets all requirements as to appearance, practical design, and sturdy construction. It affords complete protection in all machine applications where the operating parts of the transmission must be protected from water, live steam, chemical fumes, or abrasives.

Easy access to the internal operating parts is provided by U-shaped recesses in the sides of the bottom section of the case which permit the removal, as a unit, of the operating parts, including the bearings of the two shafts as well as the shifting and belt tightening screws. Removal of the lid permits minor adjustments, inspection of the operating parts, and so on.

The outstanding feature of the enclosed transmission is the improvement in lubrication facilities. All bearings are lubricated through force-feed fittings which are located in recessed panels at one end of the transmission. From these eight fittings rigid copper tubes

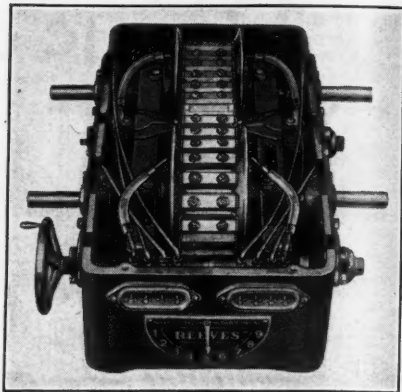


Reeves Enclosed Variable Speed Transmission.

lead to the four radial shaft bearings and flexible copper tubes lead to the four thrust bearings fitted around the disc hubs. By means of openings from the thrust bearings, the lubricant is also forced into the spiral grooves of the disc

hub bores, thus thoroughly lubricating the disc hubs, shafts, and driving keys.

The Reeves enclosed transmission is built in six sizes, covering requirements from fractional to 10 h.p. in all speed ranges, and can be mounted on floor, ceiling, or in a vertical position, as re-

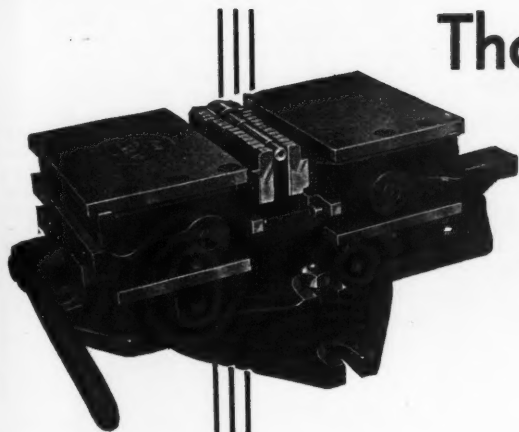


Unit with top cover removed, showing "centralized" lubrication feature.

quired. The cover section accommodates adjustable motor rails and cross rails on which a complete motor unit or auxiliary countershaft may be mounted for varying requirements of machine-speed control. These rails are bolted to each side of the transmission cover, outside the space occupied by the lid of the cover section, leaving the lid entirely accessible for removal. The cross rails on which the motor is mounted are also slotted for adjustment, and will permit any type or design of motor of the proper horse power requirements to be mounted.

### Peerless Model 3 Chamfering Machine

The work head on the Model 3 Peerless Chamfering Machine, made by the City Machine & Tool Works, June and East Fifty-third Sts., Dayton, Ohio, is now operated independently by a Master geared-head reduction motor, indicated at A in the illustration. This construction eliminates all gearing and universal shafts formerly used in transmitting power from the machine motor in the base. The change in design is intended

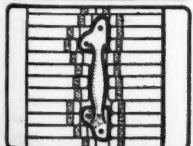
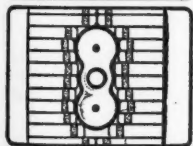
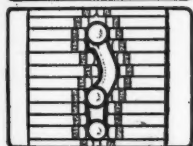
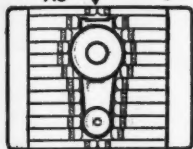


The

*Berjo*

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HOLDS SECURELY  
SUCH ODD SHAPES  
AS



Holds any shape . . . no matter how irregular . . . in a giant-like grip. Let us show you. Mail coupon.



THE AVEY DRILLING MACHINE CO.  
CINCINNATI, OHIO

Send me a bulletin on the Berjo Vise.

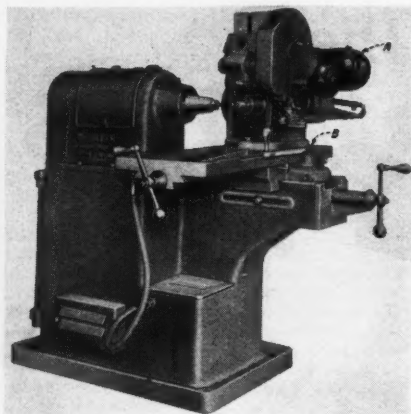
Name . . . . . Title . . . . .

Firm . . . . .

Address . . . . .

City . . . . . State . . . . .





Peerless Model 3 Chamfering Machine.

to provide a more flexible operation and permit a more adaptable method of changing speeds.

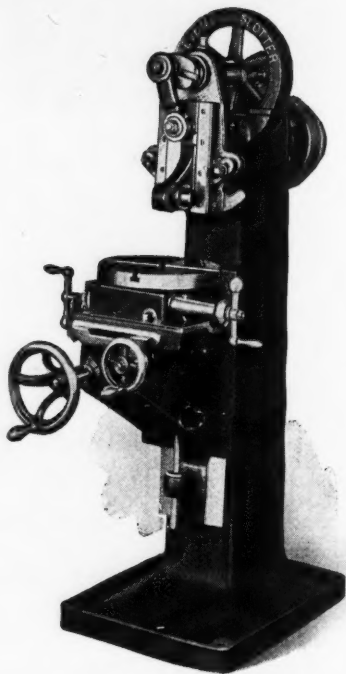
The machine shown in the illustration is also equipped with a rapid traverse mechanism, the operating lever of which is indicated at **B**. The feature of this mechanism is that it provides a means of reducing the loading and unloading time, particularly on the chamfering of internal gears. The rapid traverse mechanism is offered as optional equipment with this machine.

### Stevens Vertical Slotter

A vertical slotting machine, designed especially for use on die work, straight and taper keyseating, dies and patterns where draught is required, and similar work within the range of the machine, has been placed on the market by John B. Stevens, Inc., 306 Hudson St., New York, N. Y. Both longitudinal and cross motions can be obtained which, together with the rotary table, provide for any outline. The rotary table worm shaft is arranged with a dial graduated in minutes. For small divisions and rapid work the table can be revolved by hand, using the lockpin which provides twelve accurate divisions, making it possible to machine squares, hexagons, and octagons.

Three different ram speeds are obtainable. The ram slide can be swiveled from 0 to 5 degrees either to the right or left of central position, and set to an

index reading in degrees. A choice of two positions for cutting tools is provided. The stroke is adjustable from 0 to 4 in., and provision is made for a tool shank diameter of  $\frac{1}{8}$  in. The diameter of the table is 12 in. and a vertical adjustment is provided for the table of  $11\frac{1}{2}$  in. The adjustment in line with the spindle is  $5\frac{1}{2}$  in. and the cross adjustment is 7 in. From the column face to the center of the tool is  $9\frac{1}{4}$  in. Width of belt required,  $2\frac{1}{2}$  in. Floor space required, 28 x 44 in. Weight, 1,150



Stevens Vertical Slotter.

pounds. The machine can be supplied for either belt or motor drive. Equipment includes a complete set of wrenches and countershaft.

### Goddard & Goddard Serrated Blade Expansion Reamers

Quick adjustment, positive positioning, and extraordinarily long life of blades are the features of the serrated blade



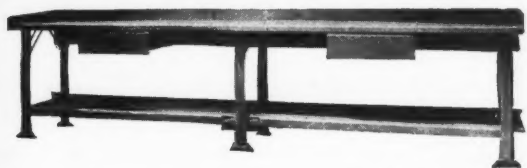
# STEEL BENCHES

## *Stand the GAFF and LIKE IT*



**No. 48-30 ALL-STEEL SHOP BENCH**  
The All-Purpose Bench for Any Shop Work

No. 48-30 Bench illustrated has heavy angle steel legs, with 12-gauge reinforced steel top and shelf. Built in widths 48, 60, and 72 inches. Two depths, 24 and 30 inches. Four heights, 30, 32, 34 and 36 inches. May be had without shelf, or drawer, or turned up back and ends, if desired. Finished throughout in olive green enamel. Shipped knocked down. Quickly and easily erected.



Illustrates how two or more Steel Benches are joined together to form a continuous section. By using the combination of 48, 60, or 72" widths, any desired length Bench may be erected.

—Also—

**SHOP DESKS  
STOOLS**

**CABINETS  
TOOL STANDS**

**TABLES  
TRUCKS**

*Write for 1931 Catalog M-S*

**ANGLE STEEL STOOL CO. PLAINWELL, MICHIGAN**  
 —The Steel Equipment People—

expansion reamers that have been brought out by the Goddard & Goddard Co., Inc., Detroit, Michigan. The new tool is an addition to the line of flat wedge-type reamers introduced by this firm about a year ago, and is intended to meet the demand for a tool of equal merit but quicker adjustment.

The reamer consists of four component parts; a heat treated alloy steel body, blades of high speed steel or other cutting metal, adjusting nut, and cam lock. Adjustment is made, as indicated in Fig. 2, by loosening setscrews C and turning adjusting nut A back one full turn, releasing blade cam lock B by turning to right 90 deg., sliding blades D back against adjusting nut, turning the adjusting nut against the blades until the required size is obtained, and locking the cams with a 90 deg. turn anti-clockwise and tightening the setscrews C.

The blade adjustment for expansion is toward the shank, as the blade slots are deepest at the reamer ends. As this longitudinal movement is only slightly more than  $\frac{1}{16}$ -in. before the blade is moved out radially to the next serration and forward again to the initial position, the blades are always held firmly in a large area contact with the body. The blades register at all times in the serrations and, as they do not contact at the bottom of the slot, any blade may be replaced at any time with a new one

$4\frac{1}{2}$ -in. size and over. Only eight blade sizes are required for the entire standard finishing reamer range of 1-in. to

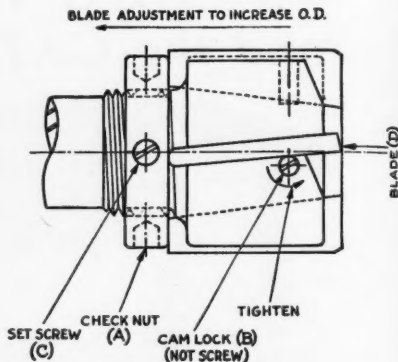


Fig. 2—Drawing showing method of adjustment.

6-in. diameters. Three standard styles of this reamer are available; shell, taper, and straight shank.

Standard blades are readily used on many special applications, thus reducing the necessary inventory of parts carried by the user. The cam lock feature is also combined, in many special jobs, with the standard roughing reamer blades which have radial serrations (as compared to longitudinal serrations on standard finishing reamers). This application is advantageous in combined reamers and spot facers, or reamers and chamfering tools, or in combinations of all three.

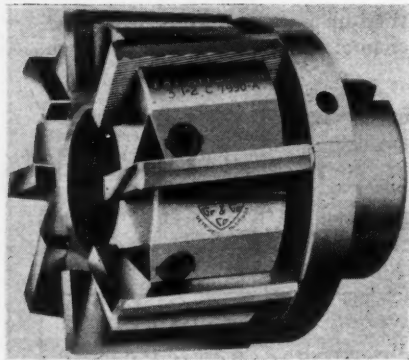


Fig. 1—Goddard & Goddard Serrated Blade Expansion Reamer.

without affecting the rest of the blades. The design of the tool provides for extremely long blade life, an expansion of 0.187 in. being provided in the 1-in. reamer, 0.250 in. in the 2-in., 0.442 in. in the 3-in. size, and 0.625 in. in reamers of

## Federal Cylinder Test Gage Model 165

A cylinder test gage for use in measuring inside diameters from  $\frac{1}{4}$  in. to  $1\frac{1}{2}$  in., to be known as the Model 165, has been placed on the market by the Federal Products Corporation, Providence, R. I. The gage was developed to meet a growing demand for a quick and accurate method of measuring small holes in work while the work is still in the machine, as well as for bench inspection purposes.

The gage consists primarily of a dial indicator, located in a frame to which is attached a "pistol-grip" handle and a sleeve in which the plunger operates. To

*a special*

## FORMICA GEAR CUTTERS

The Akron Gear & Eng. Co.  
Akron, Ohio  
Farrel-Birmingham Co., Inc.  
Buffalo, N. Y.  
Slaysman & Company  
Baltimore, Md.  
Harry A. Moore  
Bangor, Me.

The Union Gear & Mach. Co.  
Boston, Mass.

The Atlantic Gear Works  
Brooklyn, N. Y.

Chicago Rawhide Mfg. Co.  
Chicago, Ill.

Perfection Gear Company  
Chicago, Ill.

Chicago Gear Company  
Chicago, Ill.

The Cincinnati Gear Co.  
Cincinnati, O.

The Greaves Mach. Tool Co.  
Cincinnati, O.

The Horsburgh & Scott Co.  
Cleveland, O.

The Stahl Gear & Mach. Co.  
Cleveland, O.

The Ferguson Gear Co.  
Gastonia, N. C.

Excello Machine Co.  
Grand Rapids, Mich.

Hartford Special Machy. Co.  
Hartford, Conn.

Kreiter Gear & Machine Co.  
Houston, Tex.

Precision Machine Co.  
Milwaukee, Wis.

The Generating Gear Co.  
Milwaukee, Wis.

Mobile Pulley & Mach. Works  
Mobile, Ala.

Berkley Mach. Works and  
Foundry Co., Norfolk, Va.

Metsselsbach-Catucci Mfg. Co.  
Newark, N. J.

E. M. Smith Machine Shop  
Peoria, Ill.

The Earle Gear & Mach. Co.  
Philadelphia, Pa.

The Pittsburgh Machine &  
Supply Co., Pittsburgh, Pa.

Standard Gear Co.  
Pittsburgh, Pa.

Rodney Davis and Sons  
Philadelphia, Pa.

The Turley Gear & Mach. Co.  
St. Louis, Mo.

Perkins Machine & Gear Co.  
Springfield, Mass.

Winfield H. Smith, Inc.  
Springville, N. Y.

Allen Lander Company  
Sodus, N. Y.

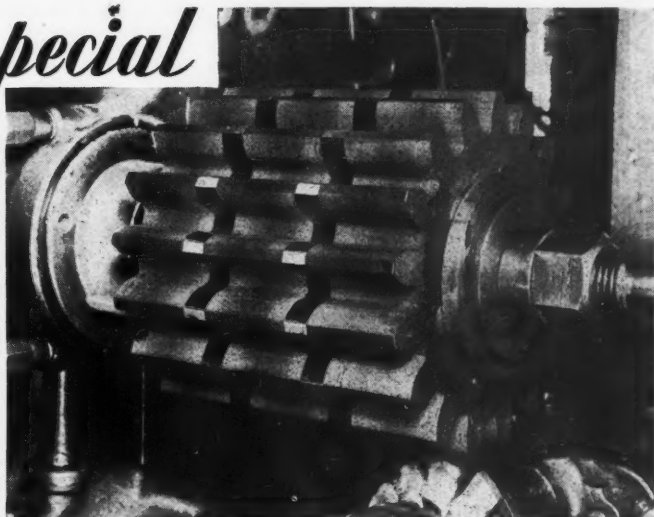
Charles E. Crofoot Gear Corp.  
South Easton, Mass.

Arlington Machine Co.  
St. Paul, Minn.

Diefendorf Gear Corp.  
Syracuse, N. Y.

Worcester Gear Works  
Worcester, Mass.

Massachusetts Gear & Tool  
Co., Woburn, Mass.



## FORMICA Gear for Heavy Drives

SOMETIMES it is desired to use Formica gears in places that were designed for steel gears—where the maximum width of face is narrower than it should be for Formica.

In such circumstances the Union Gear and Machine Co. of Boston builds up a Formica gear by inserting brass plates in it.

These plates add to the strength of the gear and enable it to stand extremely heavy loads while at the same time the combination remains quiet.

The silent operation made possible by Formica increases efficiency in the factory. It makes mechanical devices of all kinds easier to sell.

Any of the gear cutters named can give you prompt service on Formica gears cut to your requirements.

THE FORMICA  
INSULATION CO.

4640 Spring Grove  
Avenue

Cincinnati, Ohio

**FORMICA**  
*Non-Metallic*  
**GEARS**

## Where Accuracy is Imperative

Taft-Peirce Precision tools and gages are invariably used.

Their world-wide reputation for precision has been secured by the exacting design and workmanship of master craftsmen and the use of the finest possible materials, always.

Regardless of the size of your production and inspection departments, the use of Taft-Peirce precision tools and gages can show a definite saving for you.

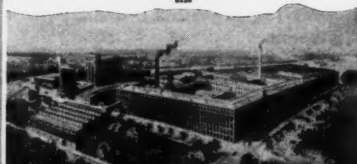
Since economy is the universal watchword, make your dollars go as far as possible.

*Send for your copy of our Hand Book if you do not have a copy.*



**The Taft-Peirce Manufacturing Company**

WOONSOCKET  RHODE ISLAND, U.S.A.



the plunger is attached a gauging plug with two contact points which can be contracted by compressing the trigger on the under side of the sleeve. With



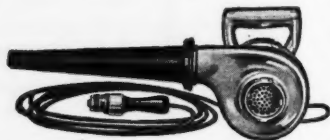
Federal Cylinder Test Gage Model 165.

the contact points contracted, the gauging plug is inserted into the hole to be gauged and the trigger is released, allowing the contact points to expand until they strike against the wall of the hole. The indicator then registers the size of the hole. The tool makes it possible to discover out-of-round or bell-mouth conditions, or to check tapers.

The gauging plugs are furnished in three lengths;  $2\frac{3}{4}$  in.,  $3\frac{3}{4}$  in., and  $5\frac{1}{4}$  in. Each individual gauging plug has a range of plus and minus 0.010 in., and plugs can be furnished to gauge holes of from  $\frac{1}{4}$  in. to  $1\frac{1}{2}$  in. diameter. Special length plugs can be furnished if desired. The dial is graduated to 0.0001 inch.

## "Tornado" Portable Electric Blower

The Breuer Electric Manufacturing Company, 852 Blackhawk St., Chicago, Ill., has placed on the market a portable electric blower for use in cleaning

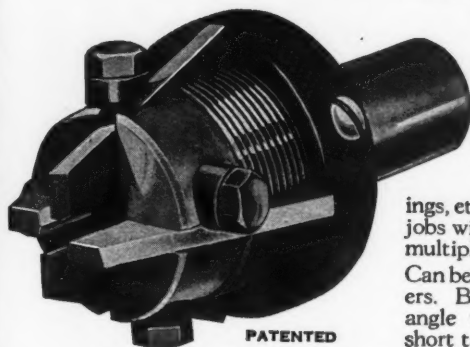


"Tornado" Portable Electric Blower

electric motors, machinery, and other plant equipment. The blower, which is known as the "Tornado," is made in two sizes, either of which will operate from any electric light socket. The Model 6 blower is driven by  $\frac{1}{2}$  h.p. G. E. universal motor, and weighs seven pounds. This blower operates at 11,930 r.p.m. and will discharge 50.5 cubic feet

# Genesee Adjustable Hollow Mill

Made in 7 different styles



Has adjustable, replaceable blades and can be replaced at nominal cost, making it unnecessary to continually buy new tools.

The ideal tool for finishing your forgings, castings, etc. Do your several operation jobs with Genesee inserted blades multiple operation tools.

Can be fitted with drills and reamers. Blades can be ground any angle to point work and turn short tapers.

*A Genesee Adjustable Hollow Mill can be made for every job*

WRITE FOR CATALOGUE

**GENESEE MANUFACTURING CO., Inc.**

ROCHESTER, NEW YORK

## WHITON LATHE CHUCKS

For

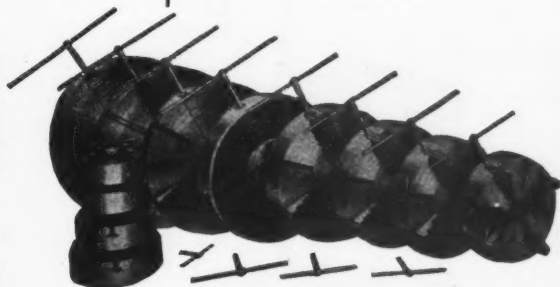
*a Sure Grip!*

**W**HEN work must be held rigidly and securely for accurate machining at top speeds — WHITON Lathe Chucks prove their superiority!

WHITON Chucks — and there's one for every requirement — are good chucks. Their design and workmanship assure you dependable service over a long period of time.

Get a WHITON Catalog — it shows the complete line of WHITON Chucks as well as many special chucks built for special requirements.

*Here is a group of WHITON Steel Body Independent Chucks designed to hold heavy work under heavy cuts at high speed. The one-piece body resists sudden strain.*



**THE D. E. WHITON MACHINE CO.**

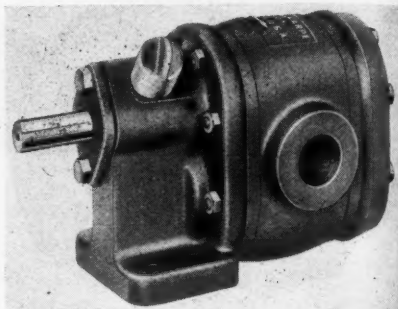
NEW LONDON CONN.

of air per minute at an average velocity of 260 feet per second. The Model 8 has a 2/5 h.p. G. E. universal motor, and weighs nine pounds. The Model 8 operates at 11,700 r.p.m. and will discharge 60.6 cubic feet of air per minute at an average velocity of 312 feet per second. The "Tornado" blower can be provided with attachments of all kinds, for converting the blower into an industrial vacuum cleaner, for spray painting, for removing dust from overhead girders or pipes, and so on.

### B & S No. 55 Rotary Geared Pump

The Brown & Sharpe Mfg. Co., Providence, R. I., is now making a rotary geared pump with ball bearings and spiral gears, to be known as the No. 55, to replace the No. 5 pump which has been withdrawn from the line. The design of the No. 55 pump includes a number of improvements which are intended to make it particularly desirable for use in supplying oil under pressure for the hydraulic operation of machines. The cap, stand, and housing of this pump

have been appreciably reinforced by having been made heavier. Further strength has been obtained by the addition of two more bolts, increasing the clamping effect by 30 per cent and permitting the use of high pressures with-



B & S No. 55 Rotary Geared Pump.

out the danger of blowing gaskets. The suction port, including the pipe tap, has been made larger to permit a freer admittance of oil. The design of the discharge port has been changed to min-

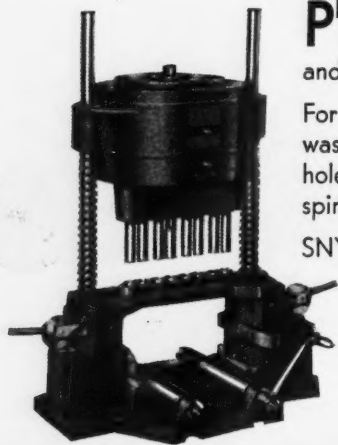


## Meet YOUR Need

**P**RODUCTION MEN specify SNYDER Set-Ups because they know that each tool is designed and built for the user's own requirements.

For instance, the tool set-up in the illustration. It was designed and built for reaming valve throat holes in a cylinder block. It consists of an eight spindle reaming head and work holding fixture.

SNYDER Set-Ups for drilling, reaming, counter-boring, etc., built to meet **your** needs means lower production costs! Let us prove it... send details of your problem!



**SNYDER TOOL & ENG. CO.**

3400 E. LAFAYETTE AVE.

DETROIT, MICH.



# Reduce YOUR Bearing Costs Increase their Life

If your company uses bearings as part of the equipment you build or for maintenance, you owe it to yourself to have the facts on

**"SABECO"**  
REG. U. S. PAT. OFF.  
**BEARING METAL**

It is a bearing metal made by a process in which the virgin copper, tin and lead are so compounded that the bearing becomes proof against burning, scoring, seizing, corroding or pounding out.

It costs nothing to have the facts.

Send for them.

**Fredericksen Company**

841 S. Water Street  
SAGINAW, MICH.

5-108 General Motors Bldg.  
DETROIT, MICH.

Room 418 E.  
30 Church St.  
NEW YORK CITY

634 Slater Bldg.  
WORCESTER, MASS.

27 S. Jefferson St.  
CHICAGO, ILL.

194 Fourth St.  
MILWAUKEE, WIS.



## GET AT THOSE "TOUGH" PLACES WITH A REGULAR INDICATOR!



*Use the B-C Indicator Finger*

This handy attachment should be in every mechanic's and inspector's tool box. It gets at these places where a regular indicator won't go—narrow ledges, hob hubs, keyways, slots, deep and narrow threads, unhandy surfaces, insides of holes, and many other awkward places. Will pay for itself in a short time in better workmanship and increased efficiency. Frame accurately made from steel forging and finger from tool steel. Black satin finish. Made to fit  $\frac{1}{2}$ " barrel. Use the order form below.

**GET  
YOURS  
TODAY!**



Price  
Complete  
In Box  
**\$2.50**

Showing how the  
Finger is applied  
to an indicator

Send this Coupon

Barber-Colman Company,  
Rockford, Illinois.  
Enclosed is (Money Order) for \$.....  
(Certified Check)

Please send me....Indicator Finger..

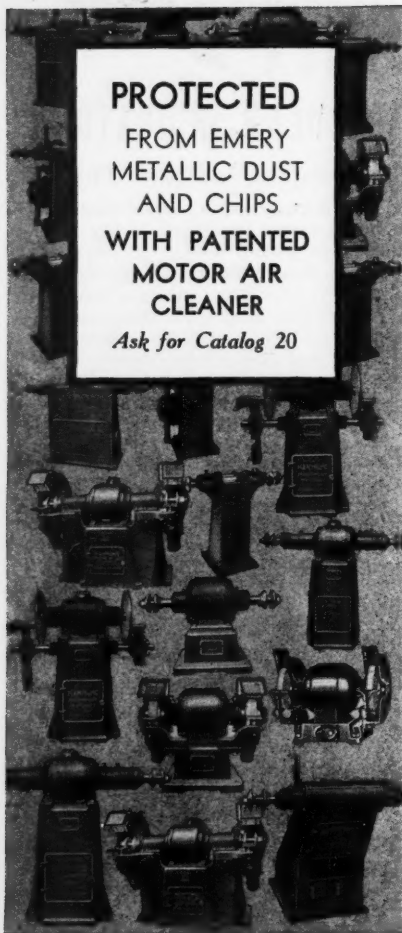
Name.....

Firm.....

Address.....

# HAMMOND

## GRINDERS & POLISHERS



### PROTECTED

FROM EMERY  
METALLIC DUST  
AND CHIPS

WITH PATENTED  
MOTOR AIR  
CLEANER

*Ask for Catalog 20*

*Hammond Machinery Builders*  
KALAMAZOO, MICHIGAN  
Grinding, Polishing & Sawing Machinery

imize the load on the bearings, thus increasing the life of the pump.

The No. 55 pump, running at from 300 to 1200 r.p.m., is capable of delivering from 9 to 36 gallons of oil per minute at zero pressure, and at 1200 r.p.m. it delivers approximately 36 gallons per minute at 100 lb. pressure. It shows very satisfactory efficiency at higher or lower pressures. The pump is substantially made, generously proportioned, quiet running and powerful, and will be particularly acceptable to manufacturers who require a pump for hydraulic applications, for Diesel engine lubrication, and so on.

### Vortex Paint-Spraying Equipment

The Vortex Manufacturing Co., 1980 W. 77th St., Cleveland, Ohio, is now marketing a smooth, lustrous white finish for the walls of industrial plants, to be known by the trade name of "Vorcolume." Vorcolume is said to be a rich, full-



Spraying "Vorcolume" Inside White with Vortex Paint - Spraying Equipment

bodied oil paint compounded especially for application by the spraying method, and is stated to be in the same price range and of the same quality as other first class paints manufactured for inside application. This company, however, features the fact that the purchas-

# No Other Lathe Like It

**WHEN** you purchase a small lathe you have a wide field from which to choose. But, nowhere will you find a lathe of simpler design, applicable to a larger variety of work, at a more reasonable price than the **SCHAFFNER 11" LATHE**.

It is the ideal tool for scores of applications in both production and maintenance work. The many features incorporated in its simple design assure you of a high degree of *speed, convenience and precision* on all work.

*Write For a Bulletin*

**The General Radial Drill Co.**

1765 ELMORE STREET

CINCINNATI, OHIO



4-Ft. Bed, \$278

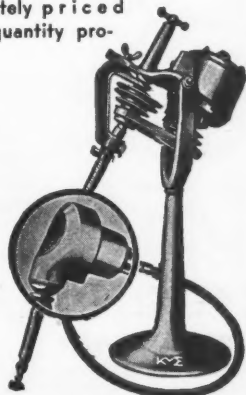
5-Ft. Bed, \$295

**"That's the Machine I Want"**

**THE KELLERFLEX**

Because — tools last longer with this machine. It is a quality machine throughout, yet moderately priced through the savings of quantity production.

Ball Bearings throughout the drive, from motor to the handpiece. Adjustable V-belt transmits a powerful drive without vibration. The whole motor mounting is carefully balanced and swivels as easily as wiggling a finger. Four normal speeds with provision for a high speed attachment, giving up to 10,500 R.P.M.



**KME KELLER MECHANICAL ENGINEERING CO.**  
84 Front Street Brooklyn, New York

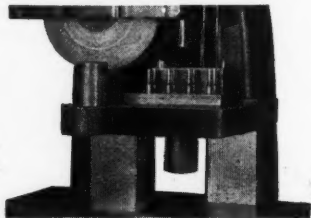
Complete Stock at Brooklyn and Chicago

er of the paint need purchase no spraying equipment—the equipment is loaned to him by the Vortex Manufacturing Company for such time as is required to complete his painting job. The equipment is simple of operation, is ready for use by filling the tank with paint and hooking up to the shop air-line, and can be operated by anyone.

### "Bulldog" Magnetic Blocks

Magnetic tables and chucks, so widely used for grinding purposes, are utilized to greater advantage when magnetic blocks are used to support the piece to be ground, without clamps or jaws. Ordinarily such blocks are made in the shop where they are used. Recently, however, a standardized, interchangeable, magnetic block to be known by the trade name of "Bulldog" has been placed on the market by the Congress Tool & Die Works, 428 South Green St., Chicago, Ill. The block offers the convenience of being ready for use, in addition to features and advantages which ordinarily are not included in the "home-made" type because of the high cost.

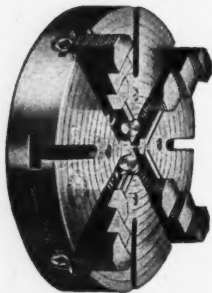
The Bulldog magnetic block is built up of laminations of special alloy "electric" steel, separated by non-magnetic layers or segments of uniform thickness. All sections are riveted together by high-tensile strength non-



Typical Set-Up with Bulldog Blocks, Showing Two Blocks Holding Down Punchholder and Punches.

magnetic rivets. The blocks are  $3\frac{3}{4} \times 2\frac{1}{4} \times 1\frac{1}{4}$  in. and all faces are ground true within the closest practical limits. The magnetic circuit has been designed so as to cut down to the minimum the hysteresis or iron loss and leakage flux between laminations. The use of the special silica alloy steel results in an exceptionally strong magnetic circuit,

## Have You An Orphan In Your Shop?

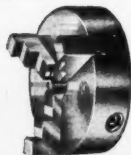


No. 264—Independent Chuck

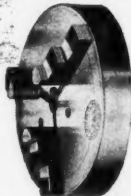
Write  
for Catalog

THERE is that orphan machine you have taken out of your production line and there is the old machine taking up valuable floor space. New Union Chucking equipment would make both tools splendid machines for those special jobs that are constantly coming up.

Union Chucks comprising a line of Independent, Universal, Combination, Boring Mill, Lathe, Planer, and Drill Press Chucks, will put these machines back in service, and give them a new lease on life.



No. 153—Universal Chuck



No. 2—Combination Chuck

## UNION MANUFACTURING CO.

NEW BRITAIN

Branch Offices:

CONNECTICUT

27 S. Jefferson St.  
Chicago, Ill.

332 Sycamore St.  
Cincinnati, Ohio

26 Cortlandt St.  
New York City, N.Y.

661 Folsom St.  
San Francisco, Calif.

440 First National Bank Bldg.  
Houston, Texas

# Swartz Fixtures

Economical first cost—convenient to tool—liberal adapter and adjustment range means less fixtures required to cover your entire needs.

**NO BREAK DOWN TIME—NO REPLACEMENT PARTS REQUIRED**

The Type L fixture shown is a standard unit tooled complete.

An inexpensive set of adapters and parts correctly located and chucked.

## COMPACT

Note the liberal adapter space in fixture relative to necessary machine table space. One of the most convenient, durable and economic tools in our plant, we believe you will say.

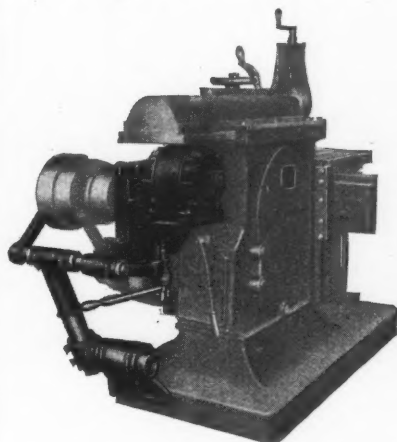
Let us tell you about the entire line of SWARTZ TOOL PRODUCTS.



*Ask for  
Catalogue  
131-B*

**SWARTZ TOOL  
PRODUCTS CO.**  
DETROIT, MICH.

# The Cullman Shaper Drive



Motorize your cone pulley Shapers, Lathes and Milling Machines with Cullman Drives. Made in 1, 2, 3 and 5 H. P. sizes. Easy to install; bolts to your machine.



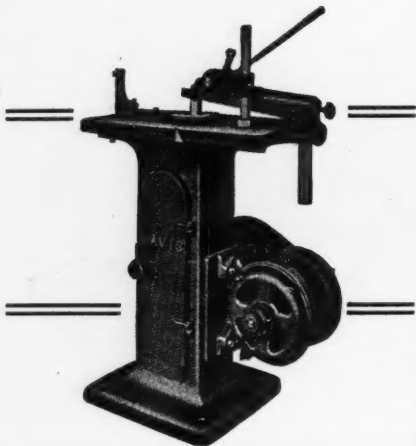
**CULLMAN  
Wheel Company**

1336 ALTGELD ST. CHICAGO, ILL.

**SPROCKETS - SPEED REDUCERS**

# Winning...

*Where Other  
Methods Fail!*



**KEYSEATING** on a shaper or some other large shop tool is costly . . . costly, due to its slow, complicated set-up.

But that's where the Davis Keyseater wins out. **TWO MINUTES** is all that is required to set up this tool for any job from  $\frac{1}{8}$ " to 1" wide and 12" high. It cuts tapered or straight keyways with equal efficiency.

Get the whole story of **DAVIS Two-Minute Set-Up** . . . it means maximum production at lower costs! Send the coupon.

## Davis Keyseater Co.

250 MILL ST. ROCHESTER, N. Y.

Send me the whole story of the Davis Keyseater and the Two-Minute Set-Up.

Firm.....

Name..... Title.....

Address.....

City.....

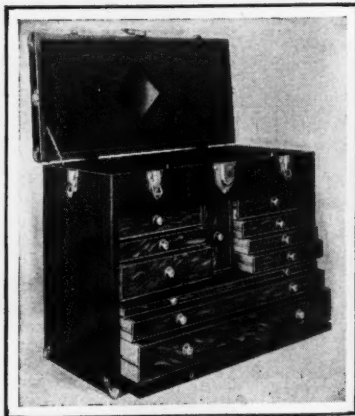
State.....

but free from residual magnetism. The result is a very powerful hold with minimum consumption of energy. One of the advantages consists in that the blocks may be placed close to the edge of the standard commercial electric chuck or table, where ordinarily neither blocks nor work can be held because the flux density is so low. Still another advantage of the high flux density is that the grip is not affected by the usual voltage fluctuations due to the starting of large motors, the operation of spot welders, and so on. The blocks will not loosen up due to sudden voltage drops.

Bulldog blocks are standardized and interchangeable, allowing the use of two, three, or more blocks where the job requires, without troublesome set-ups or measurements. Because of the efficient magnetic circuit constituted by these blocks, two or three blocks may also be mounted on top of each other in series or placed alongside of each other. The blocks are sold in pairs, greased and sealed in waxed paper.

## Gerstner "Style 42" Tool Chest

A new style of tool chest for machinists, toolmakers, and other mechanics has been placed on the market by H. Gerstner & Sons, 1285 Columbia St.,



Gerstner "Style 42" Tool Chest

Dayton, Ohio. The chest, which is known as the "Style 42," has a roomy top compartment and 11 drawers of assorted sizes. There are three full-length drawers measuring  $18\frac{1}{4}$  in. inside length, and seven drawers  $7\frac{1}{2}$  in. long,



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April, 1931

Modern Machine Shop 93

## The REINEKER Full Universal HOBBIING MACHINE



... is the ideal tool for every shop where a variety of work must be handled quickly and easily.

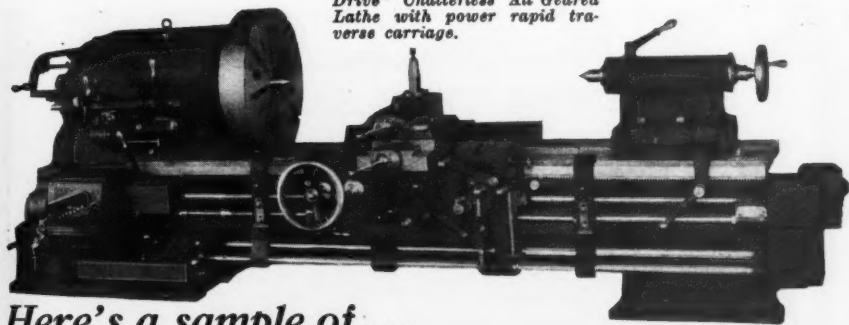
It will hob all kinds of gears... spur gears, spiral gears, helical or herringbone gears... in less time than by any other method. *Worm gears may be hobbled by two different methods*

... the In-feed or the Tangential method. The latter permits the use of flycutters instead of expensive hobs.

Investigate REINECKER Advantages... why it is the best hobbing machine you can buy! Write for bulletins.

**GEORGE SCHERR COMPANY, Inc.**  
142 LIBERTY STREET  
NEW YORK, N. Y.

*BRADFORD 30-inch "Lo-Drive" Chatterless All Geared Lathe with power rapid traverse carriage.*



*Here's a sample of...*

## BRADFORD PERFORMANCE!

**T**he following test, made on the BRADFORD lathe shown above, illustrates the kind of service you get from these tools.

A bar of 60 carbon steel, 8" diameter, was placed in this lathe and run at a speed of 75 surface feet per minute. The feed used

was  $1/32$ " and the depth of cut  $1\frac{1}{4}$ ". The result obtained was a smooth finish absolutely free of all chatter marks.

BRADFORD Lathes give chatterless performance on all cuts—even heavy intermittent cuts. Get the whole story—send for a catalog!

**BRADFORD MACHINE TOOL CO.** 659 EVANS STREET  
CINCINNATI, OHIO

these measurements having been decided upon after making a survey of the tools ordinarily needed as a complete kit by the first-class mechanic or toolmaker. A center drawer is also provided to receive a drill block or hand book.

The front lid of the chest slides on a steel bearing under the bottom drawer. It will swing up and lock automatically when the top lid is down. The chest is finished either in a black sealgrain art leather, or in polished quartered oak. The trimmings are heavily nickel-plated, and the chest is provided with a strong lock and steel-cored leather handle. The drawer bottoms are felt-lined, and the sides of the drawers are shel-laced.

### Starrett Feeler Gage

The L. S. Starrett Company, Athol, Mass., is now marketing a thickness gage, the No. 78, which is intended to fill the need for a thickness gage of small size and wide range of adaptability. The gage has six leaves; 0.0015, 0.002, 0.003, 0.004, 0.006, and 0.015 in. in thickness, giving a range by thousandths

of an inch from 0.0015 in. to 0.031 in. The leaves are protected by a steel case, held by a screw-and-stud arrangement which allows them to be replaced when



Starrett No. 78 Feeler Gage.

damaged. An eyelet in the end of the case allows the gage to be carried on a ring for protection against loss. As the gage is less than 3 in. long, it fits easily into the pocket.

## S I E W E K

### TEST SIEWEK TIME SAVING TOOLS

Higher production, lower costs! To attain these twin goals is the aim of every manufacturer. Siewek Rapid Drill Jigs, Drill Heads and Fixture Locks can help. Consider *Cushion Clamping* of Siewek Rapid Drill Jigs. Efficiency is promoted. Loading time is

#### SIEWEK TOOL COMPANY

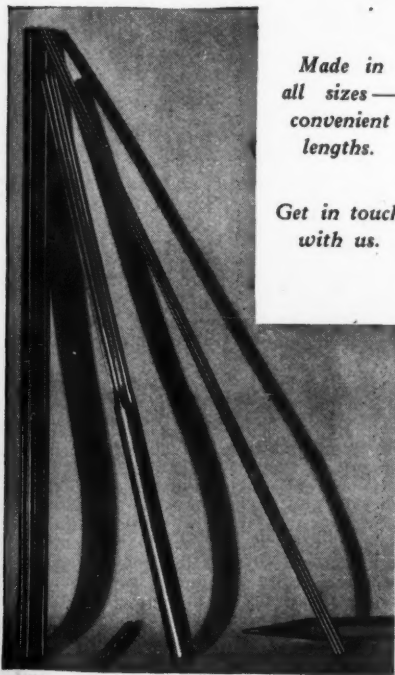
10232 Woodward Ave., Detroit, Mich.

decreased. Production is increased. This feature plus Siewek speed, accuracy and dependability reduces operating cost to a minimum. Try Siewek tools. Test their time saving ability. We'll make immediate delivery on standard sizes. Write for our new No. 3 Catalogue.



## There's Economy In M-C Pinion Rod

AS ON all classes of Standard and Special Gears, M-C facilities guarantee substantial savings on Pinion Rod. The unusual end-to-end precision of this M-C specialty insures greater accuracy and uniformity of the pinions when cut.



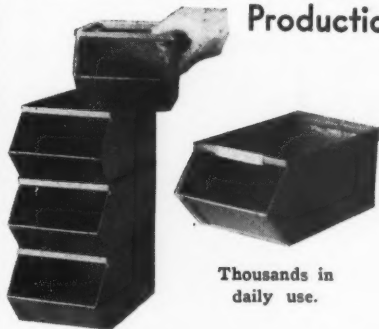
*Made in  
all sizes—  
convenient  
lengths.*

*Get in touch  
with us.*

**Meisselbach-Catucci Mfg. Co.**

70 STANTON STREET  
NEWARK, NEW JERSEY

## Stackbins Save Space— Time and Costs >>> Increase Production



Thousands in  
daily use.

## NOW PARTS CAN BE STACKED AND STILL BE ACCESSIBLE!

Bins nest deeply into one another. No amount of vibration will unstack them. They must be lifted out of each other.

Ideal for assembly, and destined to make old assembly methods obsolete. Place many parts within easy reach of assembler. Parts in bins easy to handle because they are always visible.

Make weighing practical for inventory purposes. Provide an expanding and contracting stockroom.

Made in four standard sizes.

Bin No.	Width	Height	Length
1	5½ in.	4 in.	12 in.
2	7½ in.	5½ in.	15 in.
3	9 in.	6½ in.	18¼ in.
4	12 in.	9½ in.	20 in.

Special sizes furnished to meet individual requirements.

## Stackbin Corporation

Pearl and Rice Streets Providence, R. I.

### STACKBIN CORPORATION

Pearl and Rice Streets, Providence, R. I.  
Kindly send illustrated circulars describing and giving prices on Stackbins.

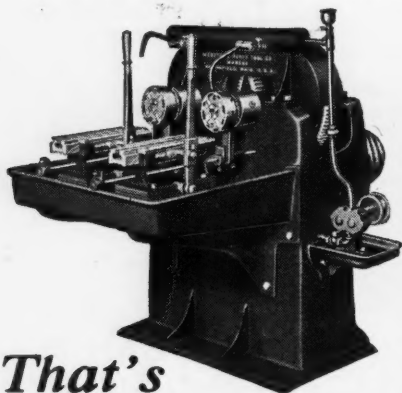
Name.....

Title.....

Firm.....

Address.....

# HIGH-SPEED THREADING



*That's*  
**ACCURATE!**

**I**N scores of operations as soon as you increase the speed...you sacrifice Accuracy. But not with a "W & P" Threading Machine... Speed is combined with Accuracy.

For instance, here's a two spindle "W & P" Threading Machine on which you can cut five hundred and fifty  $\frac{5}{8}$ " U.S.S. threads, standard screw length per hour and every thread will be accurate!

The solution to *your* threading problem is here. Send details of your job and let us show you.

*Write for Bulletin!*

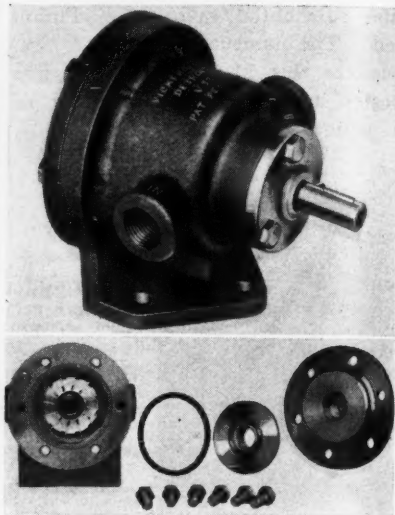
**The MITCHELL  
ENGINEERING CO.**

SPRINGFIELD

OHIO

## Vickers V-Type Rotary Pump

High volumetric efficiency, 500 lb. per sq. in. continuous working pressure and 1,000 lb. for press work, high mechanical efficiency, and long life with quiet operation are said to be characteristic of the Vickers V-Type Rotary Pump, which has been placed on the market by Vickers Incorporated, 7752 Dubois Street, Detroit, Michigan. The pump is now available in two sizes, with capacities of 15



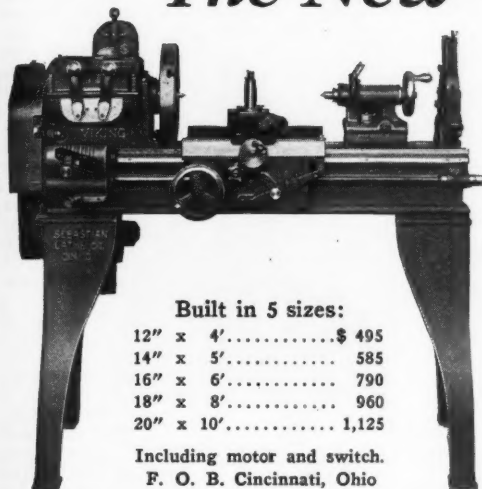
(Above)—Vickers V-type rotary pump. (Below)—Pump with flange and bushing removed to show pumping chamber.

and 30 gal. per min. at 1,000 r.p.m. The pumps are intended for use in all kinds of machinery where hydraulic feeds and controls are desired.

As indicated by the illustration, all working parts may readily be removed from one end without disturbing the motor connection or pump piping. The harmonic curves in the ring at the ports provide balanced pressure on both sides of the vanes, thus eliminating side thrust and consequent wear on bearings. Performance curves show that there is no appreciable drop in volumetric efficiency and delivery at high pressures, and that the overall mechanical efficiency is practically constant at from 500 to 1,000 lb. pressure.

All parts are interchangeable, and larger capacity can be obtained by changing the internal parts. The in-

# The New "VIKING" is here!



## Built in 5 sizes:

12" x 4'	\$ 495
14" x 5'	585
16" x 6'	790
18" x 8'	960
20" x 10'	1,125

Including motor and switch.  
F. O. B. Cincinnati, Ohio

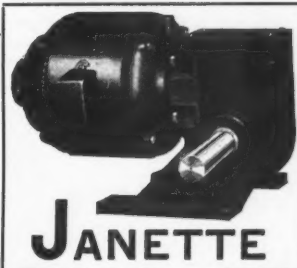
THE new "VIKING" Lathe is the choice of the shopman who knows good lathes, because its design includes many outstanding features, such as eight spindle speeds, silent chain motor drive, reverse in apron, etc.

In addition, it is exceptionally simple to operate.

The New "VIKING" Catalog is just off the press. A copy is yours for the asking.

**THE SEBASTIAN LATHE CO.** 1 CULVERT STREET  
CINCINNATI, OHIO.

## Slow Speed Drive Assembly Complete in One Unit



**M**OTOR, coupling, speed reducer—all in one unit. Simplifies assembly—easy as putting on a motor alone. Takes up little more room than a bare motor. Solves many difficult problems of design and assembly.

Built to stand up! Thousands of units now pleasing users in many different applications. 1/30 to  $\frac{3}{4}$  H. P.—AC or DC.

WRITE FOR BULLETIN SR-131

**JANETTE MANUFACTURING CO.**

Singer Bldg.  
149 Broadway  
New York City

558 WEST MONROE ST., CHICAGO, ILL.  
Harrison Sales Co., 314 Ninth Ave., N., Seattle, Wash.

Real Estate  
Trust Bldg.  
Philadelphia

stallation space required is said to be small in relation to capacity, the weight of the pump being but 32 pounds. The rotor, rings, and vanes are of alloy steel, hardened and ground, and the port bushing and flange bushing are of hydraulic bronze. The body is of special high-test nickel cast iron. Packing is not under oil pressure, and the body is completely drained to eliminate oil leakage.

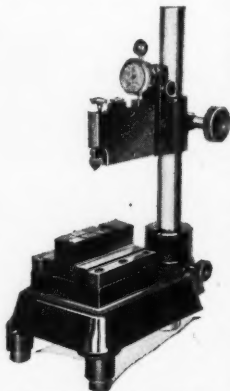
### "Precision" Amplifying Comparator

An amplifying comparator with a two-piece action which has neither bearings, pins, trunnions, or active springs, has been brought out by the Precision Gage and Tool Co., 318 East Third Street, Dayton, Ohio. The simplicity of design eliminates friction and unnecessary load, yet is said to combine sensitivity with accuracy within 0.0005 in. The two moving parts are entirely encased in a dust-proof case and require no attention whatever, not even oiling. These two parts are generated to specially-designed gages, and are assembled so that they are always in contact in the direc-

tion in which they will move in action. Thus lost motion is eliminated, and positive, rigid, frictionless action is obtained. The amplification ratio is 10:1 as stand-

ard equipment.

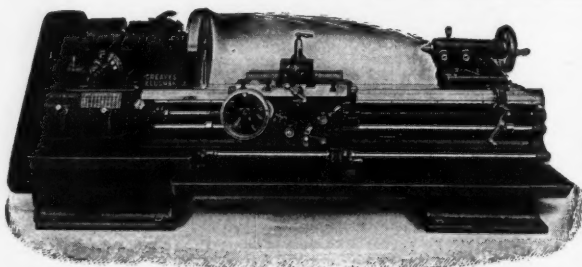
The amplifying unit is mounted on a hardened and ground vertical post, 16 in. in height, which is anchored in a rugged base about 6 x 10 in. The unit may be instantly adjusted to any position up to a height of 14 in. As it is sometimes desirable, when measuring small work, to see the contact of the ball with the work, the rear foot of the three rubber-tipped feet has been made adjustable so that the tool may be tilted backward. The measuring range, when the work is placed on the platen in the usual



"Precision" Amplifying Comparator.

## G. K. SINGLE LEVER CONTROL

**Saves  
Wasted  
Minutes!**



G.K. Single Lever Control means saving wasted minutes!

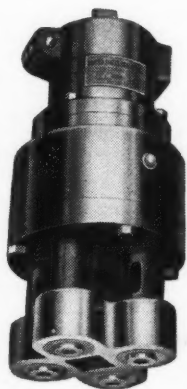
In other words, instead of searching through several combinations of levers for the right speed, the operator merely reaches for one

lever and instantly shifts to the proper speed. Minutes thus saved lower production costs!

Send for a G.K. Catalog...it describes many more features of interest to production men.

**THE GREAVES-KLUSMAN TOOL CO., CIN'TI, O.**





## Multiple Units

### *From Single Drills*

Designed to fit any type of drill press, a U. S. Drill Head converts any single spindle drill into a multiple unit quickly.

No time wasted making adjustments—spindles are fixed. Any number of holes, fifty if necessary, can be drilled as easily as one.

We will design a U. S. Multiple Drill Head to meet your individual requirements. Tell us your needs. Address

**The United States Drill Head Co.**

1954 Riverside Drive  
Cincinnati, O., U. S. A.

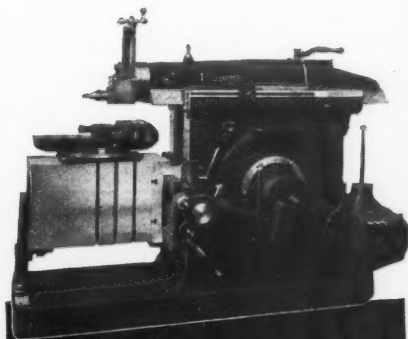


# Ranks First!

IN scores of plants throughout the country, records show that the COLUMBIA "Superior" SHAPER ranks first, when it comes to economical performance under all conditions.

That's the kind of performance you can expect from a COLUMBIA "Superior." Its massive column and base, heavy arch type ram, extra large table with outer support, hardened alloy-steel drive gears, flood lubrication, all parts proportioned for maximum strength and durability, are some of the features which make such records possible.

For full details send for  
BULLETIN 17



**THE COLUMBIA  
MACHINE TOOL CO.  
HAMILTON, OHIO**

## TURN YOUR DOOR KNOB



and the door is closed.  
That is all the action  
you need with a

## Boker Chuck NO KEY

**30 Days' Free Trial**

**Concentric, simple, ac-  
curate; only 3 parts.**

**H. BOKER CO., Inc.**  
103 Duane St., New York, N. Y.

**Send particulars, 30 days free  
trial.**

**Name** .....

**Firm** .....

**Address** .....

**City** ..... **State** .....

manner, is from 0 to  $8\frac{1}{2}$  in. The platen may easily be removed for resurfacing, or so that special fixtures can be mounted.

The small ball point under which the work to be checked is passed is tipped with Stellite as standard equipment, but may be furnished with a diamond tip if desired. The ball point is  $\frac{3}{8}$  in. diameter. The spindle to which the ball is attached is held down by a small weight, which provides a constant load and even pressure without causing undue wear on the mechanism. The dial has a range of 0.013 in., and is graduated by half-tenths. The tool is designed for every-day shop use where dependable accuracy must be combined with ability to withstand constant usage.

### "Sturdimatic" Live Center

The difficulties that arise from the use of solid centers in machine tailstocks can be avoided by the use of ball-bearing centers, such as that shown in Fig.

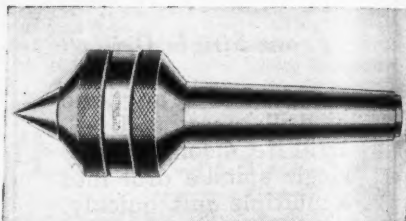


Fig. 1—"Sturdimatic" Live Center

1. In this center, which is made by the Sturdimatic Tool Co., 12123 Cardoni Avenue, Detroit, Michigan, the center proper rotates in two heavy duty ball bearings which not only allow the center to rotate freely and without friction,

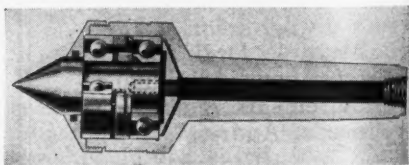


Fig. 2—Cross section drawing of center, showing design.

but which also take both thrust and radial loads.

The center consists primarily of the center proper, which is called the rotor, the shank with which is incorporated

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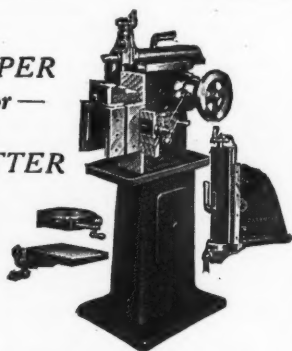
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As a  
**SHAPER**

— or —

As a  
**SLOTTER**

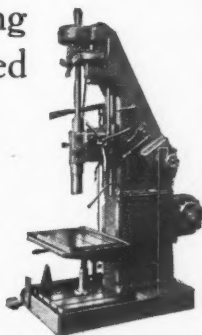


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and  
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Cuts  
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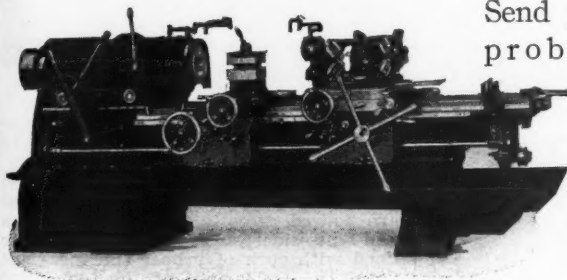
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duction drilling and  
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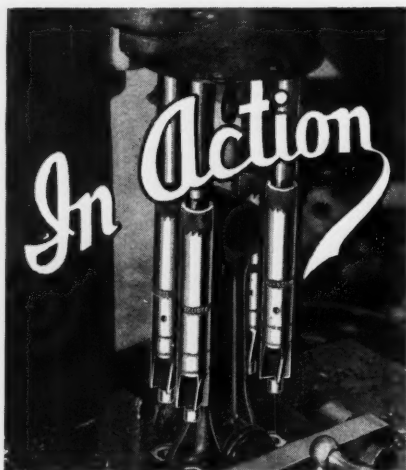
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always at your  
service.

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Detroit, Michigan

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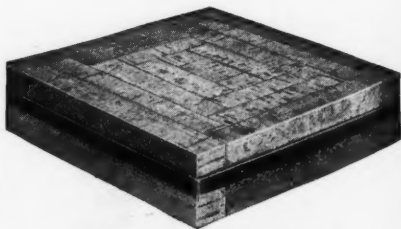
City..... State.....

the housing for the mechanism, the two ball bearings, two specially-designed steel cushioning members, and the cap that holds the mechanism intact. The cushioning members are located between the two ball bearing races, and operate to distribute the thrust and radial loads between the ball bearings, thus maintaining rigidity and alignment. The rotor is ground after assembling, thus insuring accuracy. The rear end of the shank has a removable threaded plug which can be removed and replaced by an Alemite fitting for lubrication. The lubricant is forced through a central channel to the bearing chamber. A felt washer in the cap protects the bearings against ingress of foreign matter at this end.

All parts are hardened and ground. The center is made in seven standard sizes, with Morse taper shanks from No. 2 to No. 7 taper, and to take combined thrust and radial loads from 1,410 lb. to 25,875 lb. Rotors of any size or shape can be furnished, and other tapers or straight shanks can be furnished on special order.

### Mundet "Jointite" Cork Board

Vibration and noise—cause and effect—can be reduced considerably in manufacturing plants by supporting the machines on mats of natural cork. Such mats, in any size or thickness required, can now be obtained from L. Mundet & Son, Inc., 461 Eighth Avenue, New York, N. Y. In some cases the machines



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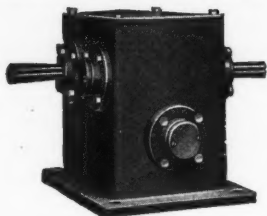
are placed directly on the cork mats; in others, heavy concrete foundations are poured directly on top of the cork and the sides of the foundations are lined with cork of proper thickness and density. The weight of the foundation plus the weight of the machines is calculated, carefully, to give the cork the correct amount of compression. The mats are of natural cork, which is

**2500-1**

is a standard ratio of reduction in



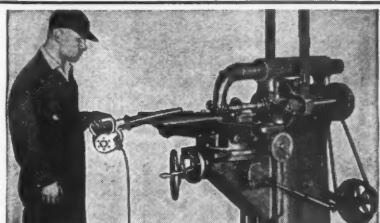
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Swing 16/32", 18/36", 20/40"



Designed for general work in all types of shops. Has ample power to turn full diameters in the gap. By sliding the top bed gap can be varied to suit the requirements of the work. With gap closed is regular engine lathe. Belt driven or all geared motor drive.

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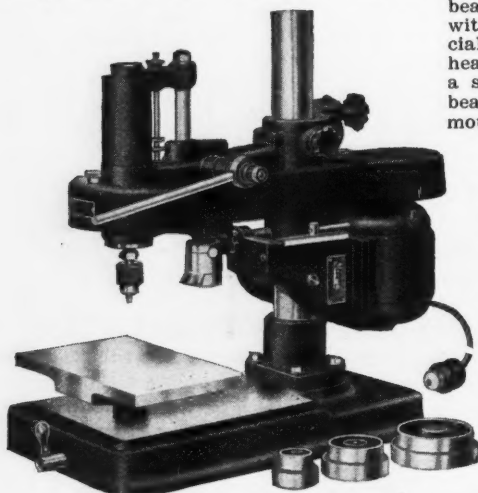
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strong in compression, is highly elastic, durable, and does not rot or harden.

Information as to size and thickness of mats required, or any other information as to foundation problems can be obtained without charge upon application to this company.

### "Maximus" A. M. Sensitive Drilling Machine

The line of "A. M." sensitive drilling machines manufactured by Adolph Muehlmann, Fifth and Elm Street, Cincinnati, Ohio, has been augmented by the addition of the "Maximus," shown



"Maximus" A.M. Sensitive Drilling Machine

in the illustration. The design of this machine is somewhat different from the design of the other sensitive drilling machines made by this firm, the principal feature consisting in that the entire mechanism of the drilling unit is suspended from the column of the machine. The extreme sensitivity of the machine is retained but the change in the design of the base permits the drilling of larger work than has been possible with the other "A. M." machines.

The base of the machine is substantial, providing a machined surface surrounded by a liberal channel. A  $1\frac{1}{4}$ -in. hole in the base, in line with the spindle, takes the shank of a  $5\frac{1}{2}$ -in. diameter round table or of any attachments that may be used. The shank of the table

may be firmly clamped by means of a handle at the front of the base. A  $10 \times 6$ -in. rectangular table is also provided, which is recessed on the under side to fit over the round table, as shown in the illustration. The machined surface of the base may also be used as a table, a plug being provided to insert into the hole so as to present a solid surface. Holes may be drilled to the center of a 16-in. circle, and this dimension may be increased to 20 in. by a slight change.

The spindle of the machine is of tool steel, hardened, ground, seasoned, and lapped. The spindle is suspended from a combination radial and thrust ball bearing located in the arm that connects with the rack rod, passing through specially-fabricated sleeve bearings in the head. The spindle pulley is mounted on a sleeve, the ends of which carry ball bearings. These bearings, in turn, are mounted in the head. There is no contact between the spindle and spindle pulley, except by the driving key which engages the spline of the spindle. Thus no driving load nor belt stress is transmitted to the spindle.

A travel of  $2\frac{1}{2}$  in. is imparted to the spindle by means of a counterpoised ratchet mechanism and lever. The drilling unit may be adjusted vertically 7 in. by means of a worm, pinion, and rack mechanism located at the upper rear part of the column girdle. A column of any desired height can, however, be supplied, on request. A Jacobs chuck of  $\frac{1}{8}$ -in. capacity is provided. The capacity of the machine is intended to be  $\frac{1}{4}$  inch.

The motor is mounted on a sliding bracket having a horizontal travel of 2 in. The motor is of the ball-bearing type and is furnished wound as required. In combination with a spindle pulley having  $3\frac{1}{2}$ -in. and 2-in. steps, four two-step pulleys are employed ranging from 5-in. in the major diameter to 2-in. with a  $\frac{1}{2}$ -in. reduction in the minor diameter. The complete set of pulleys provides a range of spindle speeds from 750 r.p.m. to 4,375 r.p.m. with a 1,750 r.p.m. motor. This speed can be increased to 8,750 with a 3,500 r.p.m. motor. Power is transmitted by means of a  $\frac{5}{8}$ -in. flat leather belt. All controls are located in the drilling unit, isolated from chips and coolant.

The head spindle bearings are oiled through the spline of the spindle at the



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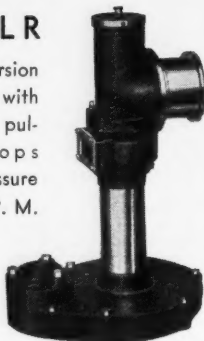
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## GUSHER COOLANT PUMP

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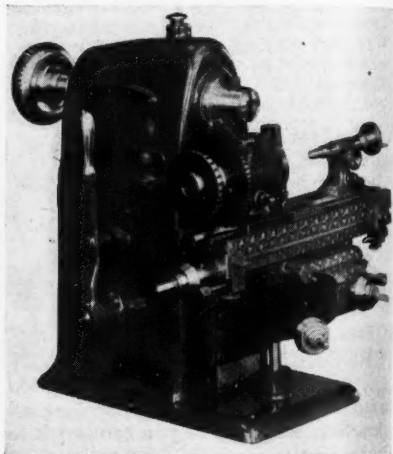
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Ruthman Machinery  
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532 East Front St. Cincinnati, Ohio

upper head bushing, lubricant being carried to the lower bearing through the spline. All other oiling points are indicated by Bennet Oilers. The ball bearings are of the sealed type. The working area is illuminated by a well-guarded 20-W, 110-Volt lamp, located under the arm, at the rear of the spindle. Both the lamp and motor switches are located at the right side of the machine within easy reach.

### "Cataract" Motor-Driven Bench Milling Machine

The illustration shows the "Cataract" Bench Milling Machine which has been placed on the market by Hardinge Brothers, Inc., 4149 Ravenswood Ave., Chicago, Ill. This machine was devel-

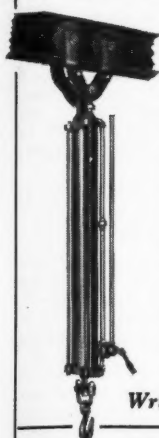


"Cataract" Motor-Driven Bench Milling Machine.

oped to augment the "Cataract" line, and the design includes a number of the same features that were incorporated in the design of the "Cataract" bench lathe.

The machine is provided with a fully-enclosed headstock with V-belt drive throughout, also a six-speed transmission with high and low speeds controlled by a clutch, with additional speeds obtainable by shifting one belt. The drive unit is mounted under the bench, eliminating overhead shafts and belts. Left-hand cutters can be used by applying a reversing type of switch to a standard

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The illustration shows KECKLEY Hoist type 3, pivot mounting arranged for monorail trolley. Built in various types and sizes.

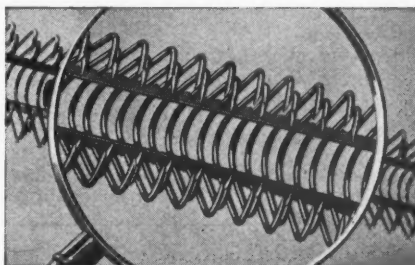
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When laced, the binder bars remain firmly fixed to every hook so that each hook must stay in its exact position and stand its pull and equal share of wear and strain.

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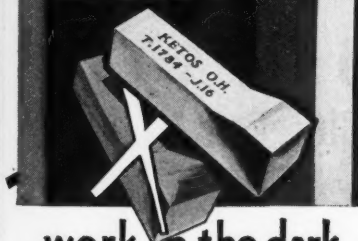
All strips are twelve inches long (84 hooks). Twelve strips, six high-quality rawhide pins and a special nipper to cut the binder bars, in each box.

Write for sample strip and give your jobber's name.

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**W**HAT kind of steel is it? Is it oil hardening or water? What job is the tool for? What is the job number? Who made it?

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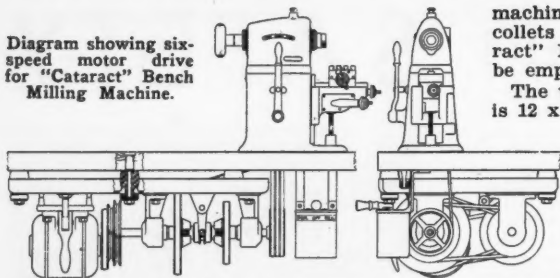
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Diagram showing six-speed motor drive for "Catacract" Bench Milling Machine.



reversible motor. The collets interchange between the cutter head of the milling

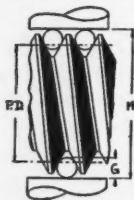
machine and the dividing head, and collets from the standard "Catacract" No. 4 bench lathe may also be employed.

The working surface of the table is 12 x 3½ in., and the longitudinal travel is 5½ in. Transverse travel of table, 4 in. Vertical travel from center of spindle, 6½ in. Range of speeds, 240 to 1725 r.p.m. Net weight, 105 pounds.

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"The Birth of a Notion" is the title of a booklet that has been issued by the National Boring Tool Co., 7625 E. Jefferson Avenue, Detroit, Michigan, in which the rotary jig and pilot bushings made by this company are fully described and illustrated. The text is augmented with illustrations which not only show how the "National" rotating bushings can and should be used, but it also reminds the reader of the grief that too often ensues when a tool or pilot is run at high speed in the ordinary type of bushing. A copy of this booklet can be had, free, by any engineer or mechanical executive.

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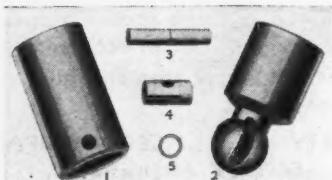
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April, 1931

Modern Machine Shop 109



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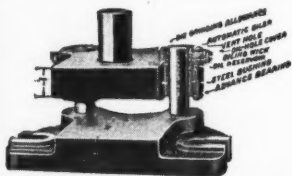
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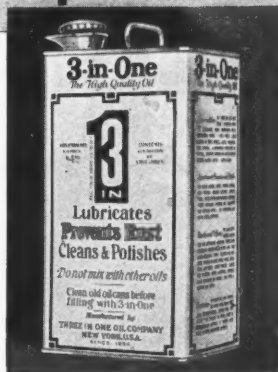


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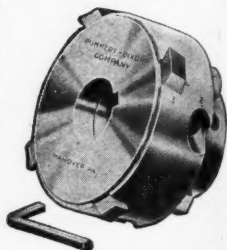


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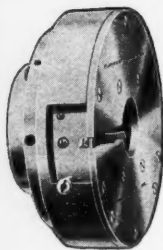
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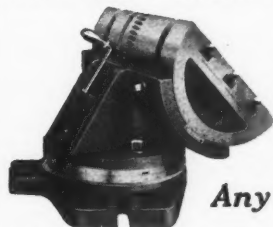
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Check any of these useful publications that you want, write your name, firm name, title, and address on the margin, then tear out the page and send to Modern Machine Shop, 128 Opera Place, Cincinnati, Ohio. They will be forwarded to you promptly without cost or obligation. Please restrict your list to not more than ten.

**Grinding Tungsten Carbide Tools:** Instructions on grinding tungsten carbide tools, including directions as to angles, types, grades, and grains of wheels, wheel speeds, and so on, are included in a folder that can be obtained without charge by addressing Abrasive Company, Tacony and Fraley Streets, Philadelphia, Penna.

**Ames Gages:** Catalog No. 50, issued by the B. C. Ames Company, Waltham, Mass., contains complete descriptions and illustrations of the dial gages, gage heads, upright gages, cylinder gages, dial micrometers, and precision verifiers, special gages and attachments made by this company. Copy free upon request.

**Scraping By Power:** Bearing surfaces can now be scraped with a power scraper that is quicker and easier than the old-fashioned hand method. The tool is described in a folder that is issued by Anderson Bros. Mfg. Co., 1926 Kishwaukee St., Rockford, Ill. Sent free on request.

**Steel Furniture for the Shop:** The complete line of steel furniture made by the Angle Steel Stool Co., Plainwell, Michigan, including steel stools and chairs, steel foremen's desks, lockers, tables, tool stands, machine tenders, shop boxes and pans, iron bar racks, trucks, bench legs, and bench drawers, is described and illustrated in Catalog "C," which is issued free to machine shop executives.

**Stop Tap Breakage:** A booklet that tells how to stop the breakage of taps, reamers, and other tools, by the use of a friction chuck, also how to use the chuck for setting studs or nuts, has been issued by The Apex Machine Co., 200 Davis Ave., Dayton, Ohio. Sent free upon request.

**Machine Shop Accessories:** Catalog B-27, issued by the Armstrong Bros. Tool Co., 328 N. Francisco Ave., Chicago, Ill., describes the line of tool holders, boring tools, wrenches, pipe tools, ratchet drills, lathe dogs, and other tools manufactured by this company.

**Hold Odd-Shaped Pieces Securely:** A vise in which odd-shaped work can be held securely without the need of special jaws or fixtures is described in a folder that has been issued by The Avey Drilling Machine Co., P. O. Box 487, Cincinnati, Ohio. Copy free upon request.

**Hobs and Milling Cutters:** A complete line of milling cutters and hobs for cutting all kinds of gears, splines, sprockets and other forms is described in Catalog G, issued by the Barber-Colman Company, Rockford, Ill. Descriptions and illustrations of the Barber-Colman hobbing machine and hob-sharpening machines are included. Sent free on request.

**All-Geared Drilling and Tapping Machines:** A catalog describing in detail the various types of all-geared, self-feeding, drilling and tapping machines made by the Barnes Drill Co., 801-851 Chestnut Street, Rockford, Ill., will be sent free upon request.

**Modern Drilling Equipment:** Circulars describing the various types and sizes of Barnes upright drills, multiple drills and horizontal drilling machines made by this company have been issued by the W. F. & John Barnes Co., Rockford, Ill.

**Automatic Oiled Die Sets:** The automatic oiled die sets, die shoes, punch holders, leader pins, bolster plates, bushings, and other standard die parts made by the E. A. Baumbach Manfg. Co., 1806 S. Kilbourn Ave., Chicago, Ill., are described in Catalog No. 5, which has been issued by that company. Sent free upon request.

**Boker Keyless Chuck:** A chuck that is built of three units, grips like a vise, and needs no key is described in a pamphlet that can be obtained by addressing H. Boker Co., Inc., 103 Duane St., New York, N. Y.

**Bradford Precision Lathes:** Precision Lathes for the tool room and for general manufacturing purposes, all-geared and cone types, belt or motor driven, are de-

scribed and illustrated in a catalog that is issued by The Bradford Machine Tool Co., 657-671 Evans St., Cincinnati, Ohio. The catalog also includes descriptions of taper, relieving, turret and other lathe attachments. Sent free upon request.

**Tornado Portable Electric Blower:** An air-blast can be had anywhere, any time, by users of the electric blower made by the Breuer Electric Mfg. Co., 845 Blackhawk Street, Chicago, Ill. Write for free folder.

**How To Sharpen Staggered Tooth Cutters, Helical Milling Cutters, and Two-Lipped End Mills:** A series of pamphlets on these subjects can be obtained without charge by addressing the Brown & Sharpe Mfg. Co., Providence, R. I.

**Disc-Inspected Tool Steels:** A bulletin discussing the advantages of disc-inspected tool steels can be had by writing to The Carpenter Steel Co., Reading, Penna.

**Gears of All Kinds** are described and illustrated, with specifications, in Catalog 90, which has been issued by the Chicago Gear Works, 105-9 S. Jefferson St., Chicago, Ill.

**Mounted Grinding Wheels:** Grinding wheels for use in small holes such as are to be found in bushings, dies, gears, etc., mounted and ready for use, are described in a bulletin that can be had by addressing the Chicago Wheel & Mfg. Co., 110 S. Aberdeen Street, Chicago, Ill.

**Electric Tools:** The complete line of "The Cincinnati" Electric Drills, Grinders, Buffers, etc., manufactured by the Cincinnati Electrical Tool Company, Cincinnati, Ohio, is fully described and illustrated in their new catalog. Free upon request.

**Rapid Traverse Planers:** Cincinnati Hypro Planers, made by the Cincinnati Planer Co., Cincinnati, Ohio, are described in a new catalog that has been issued by this company.

**Bolender Gear Burnishers:** Gears will operate more smoothly and more silently if burnished. Full description of the Bolender Gear Burnisher can be had by addressing the City Machine & Tool Works, Third and June Sts., Dayton, Ohio.

**Handbook For Drillers:** The Cleveland Twist Drill Co., 1242 E. Forty-ninth St., Cleveland, Ohio, has published a book in which the various parts of the twist drill are described, and which tells how to grind a drill correctly. The troubles that result from incorrect grinding are described and illustrated and several chapters are devoted to the subjects of speeds, feeds, materials, cutting compounds, and so on. Sent free upon request.

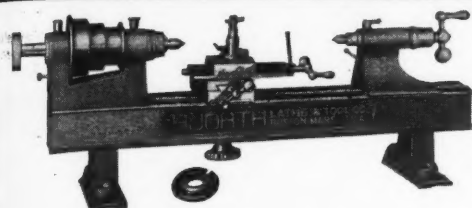
**Grinding Equipment:** Covel surface grinders, universal tool and cutter grinders, and Yankee drill grinders are described and illustrated in a catalog that can be had without charge by addressing the Covel Manufacturing Co., Benton Harbor, Michigan.

**Columbia Superior Shapers:** Bulletin No. 17, issued by The Columbia Machine Tool Co., Hamilton, Ohio, describes and illustrates the line of heavy duty shapers made by this firm. Copy free upon request.

**Tool Steel Handbook:** This book, published by the Columbia Tool Steel Company, 550 E. 14th Street, Chicago Heights, Ill., contains descriptions and information as to correct use of tool steels. Also hints on how to avoid hardening failures, with information on heat treating methods and valuable information tables. Copy free upon request.

**Motorize Your Cone Pulley Lathes:** An attachment that can be applied to your lathe with four bolts makes it possible to motorize and modernize your lathes. Write for information to Cullman Wheel Co., 1336 Altgeld St., Chicago, Ill.

**Davis Keyseaters:** Recent developments in keyseating methods are discussed in a bulletin that also describes the keyseaters made by the Davis Keyseater Company, 250 Mill St., Rochester, N. Y. Copy free upon request.



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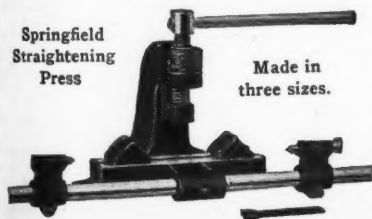
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**Grinding Wheel Dressers:** All of the different types of grinding wheel dressers made by the Desmond-Stephan Mfg. Co., Urbana, Ohio, including Desmond-Huntington, Desmond-Sherman, Zig-Zag, Diamo-Carbo, and diamond dressers, are described and illustrated in a catalog that has been published by the firm mentioned. Free upon request.

**Precision Grinding:** A booklet which describes and illustrates the most modern methods of performing all kinds of precision grinding operations, showing how the Dumore grinder can be applied to various kinds of machine tools, has been published by The Dumore Company, Racine, Wis. Copy free upon request.

**V-Belt Drives:** The V-Belt Drives, gears, and speed reducers made by the Eberhardt-Denver Gear Works, 1408 West Colfax, Denver, Colo., are fully described in a catalog that has been issued by this firm. Copy free upon request.

**Interchangeable High Production Tools:** Catalog No. 28, issued free by the Eclipse Counterbore Co., 7410 St. Aubin St., Detroit, Mich., describes and illustrates the interchangeable counterbores, spot facers, end form cutters, and other end cutting tools made by this firm.

**Grooved Cast Iron Pulleys:** All sizes of the cast iron grooved pulleys made by the Efficient Grooved Pulley Co., 147 Baxter Street, New York, N. Y., are described in a folder that has been issued by this firm. Copy free upon request.

**"Ramet" Cutting Metal:** A cutting metal which is neither a steel nor a composition of tungsten and cobalt, but which is said to cut alloy steels, manganese steel, or any other metal composition, is described in a folder that will be sent free upon application to Fansteel Products Co., Inc., North Chicago, Ill.

**Lathe Turrets** of eight different types and twelve sizes are described and illustrated in Circular No. 18, issued by Fay & Scott, Dexter, Maine. Copies free upon request.

**Precision Measuring Instruments:** The latest types and models of dial indicators, thread lead test gages, pitch gages, thickness gages, dial comparators, and other precision measuring instruments marketed by the Federal Product Corporation, Providence, R. I., are described and illustrated in a book that will be sent free upon application to this firm.

**The Involute Gear Simply Explained:** A direct, clear explanation of the theory and principles of involute gearing without the use of higher mathematics can be obtained without charge by addressing The Fellows Gear Shaper Co., 78 River St., Springfield, Vt.

**Formica Silent Composition Gears:** A booklet telling about the uses and advantages of Formica Silent Shock Absorbing Gears, and containing a considerable amount of valuable data with rules and tables for laying out, cutting and using gears. Sent free by Formica Insulation Co., 4632 Spring Grove Avenue, Cincinnati, Ohio.

**Reduce Your Bearing Costs:** A bearing metal that is proof against burning, scoring, seizing, corroding, or pounding out is being made by the Fredericksen Company, 841 South Water Street, Saginaw, Michigan. Send for information.

**Gear Chucks:** Gears can be chucked from the pitch line by the use of a chuck that is made by the Garrison Machine Works, Inc., Dayton, Ohio. Descriptive booklet free upon request.

**The Schaffner 11-In. Lathe** is described and illustrated in a bulletin which can be obtained without charge by addressing The General Radial Drill Co., 1767 Elmore Street, Cincinnati, Ohio.

**Adjustable Blade Cutters:** Hollow mills, facing tools, face mills, milling cutters and other production tools with adjustable, interchangeable blades are described and illustrated in a booklet that is issued free by the Genesee Manufacturing Co., 141 N. Water St., Rochester, N. Y.

**Take Care of Your Tools** by keeping them in a convenient, strong, and fine-looking chest. A catalog of tool chests, complete with descriptions and illustrations, can be had by addressing H. Gerstner & Sons, 1283 Columbia Street, Dayton, Ohio.

**The Reamer You Have Been Looking For:** An adjustable reamer with the rigidity of a solid tool, with quick and accurate adjustment, and built for long life is described in a catalog that can be had without

charge by addressing the Goddard & Goddard Co., 12280 Burt Road, Detroit, Mich.

**Machine Vises** of all sizes for use with machine shop equipment are described in a circular that will be sent free upon application to The Graham Mfg. Co., 69 Willard Ave., Providence, R. I.

**Greaves-Klusman Lathes:** A book containing complete descriptions of the latest types of lathes made by this firm has been issued by the Greaves-Klusman Tool Co., Oakley, Cincinnati, Ohio.

**Swiss Files:** The complete line of Grobet Swiss Files for use in die and tool work or for other fine work is described and illustrated in Catalog "K," published by the Grobet File Corporation of America, 3 Park Place, New York, N. Y. Copy free upon request.

**Drawing Tables:** The Hamilton steel-base, adjustable drawing table is described in Catalog No. 7-MS, issued by the Hamilton Mfg. Co., Two Rivers, Wis. Copy free upon request.

**Grinding, Polishing and Buffing Machines** of the latest types are described and illustrated in a series of bulletins that have been issued by the Hammond Machinery Builders, Kalamazoo, Mich. Copies free upon request.

**Textride Grinders for Vitrified or High Speed Wheels:** A six-page bulletin No. 43 describes in detail and illustrates the advantages of the new Hisey Textride Grinder—stressing especially the multi-speed and single-speed machines. Write for a copy to The Hisey-Wolf Machine Co., Colerain and Marshall Sts., Cincinnati, O.

**Precision Bench Lathe Work** can only be done on finely-built, accurate machines. The complete line of Hisey Precision Bench Lathes is described and illustrated in a catalog that has been issued by Hisey Lathe & Tool Company, 24 School Street, Boston, Mass. Copy free upon request.

**Useful Tool Information:** The Illinois Tool Works, 2503 N. Keeler Ave., Chicago, has published a catalog which describes and illustrates the standard and special cutters, mills, hobs, gear cutters, thread cutters, saws, reamers, and other tools made by this firm. The book also contains a number of useful tables and formulas. Copy free upon request.

**Oil and Waterproof Chucks:** The J & H Electric Co., 202 Richmond Street, Providence, R. I., is now making a chuck that is oil and waterproof, and is designed to provide a maximum of holding surface with exceptionally strong and uniform pull throughout. Ask for complete information.

**Slow Speed Drive Assembly:** A motor, coupling, and speed reducer combined in one unit can now be obtained from the Janette Manufacturing Co., 558 West Monroe Street, Chicago, Ill. Ask for Bulletin SR-131.

**Special Mill-Waukee-Mills of Standard Units:** A milling machine of which the base, heads, columns, and other parts are built in standard units, thus enabling the user to order a machine that will be especially adapted for his job, is described and illustrated in Catalog No. 36, issued by the Kearney & Trecker Corporation, Milwaukee, Wis. Free to machine shop executives.

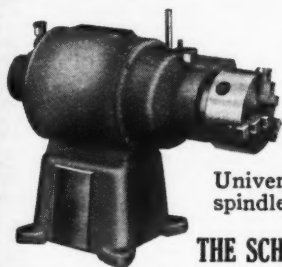
**Lift by Air** with a Keckley Pneumatic Hoist, made by O. C. Keckley Co., 563 Washington Blvd., Chicago, Ill. Write for Bulletin 1304.

**Keller Automatic Toolroom Machine** for machining dies, metal patterns, jigs, core boxes, molds, and other irregular parts is fully described in a booklet that can be had free by addressing the Keller Mechanical Engineering Corp., 84 Front Street, Brooklyn, N. Y.

**Koebel-Wagner Diamonds for Wheel Dressing:** The Koebel-Wagner method of mounting diamonds and the use of the "Dykon" gage are discussed in a bulletin issued by the Koebel-Wagner Corporation, 144 Orange St., Newark, N. J. Free upon request.

**Threading Machinery:** Catalog No. 32, containing full descriptions of Landis threading machines, slay bolt threading machines, bolt factory threading machines, automatic forming and threading machines and chuck grinders can be had without charge by addressing Landis Machine Co., Inc., Waynesboro, Penna.

**Flexibility in Cylindrical Grinding** means increased production, need for less equipment, and lower cost. Send for information as to the advantages of Landis



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**FOR** lapping-finishing-polishing of small parts  
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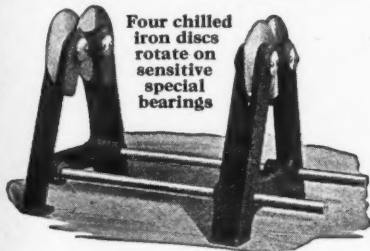
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A simple and  
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and truing.

They are made in  
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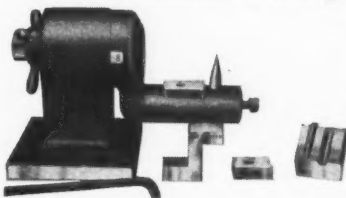


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*Eliminate Hand-Fitting!*



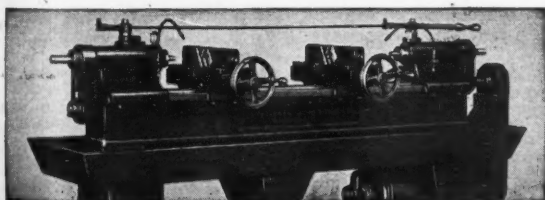
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This tool enables your operator to easily  
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**Rockford, Illinois**



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**Cutter and Tool Grinding:** A book that tells how to grind tools and cutters accurately and which also describes and illustrates the different types of LeBlond Universal Tool Room Grinders will be sent free upon request. Address, The R. K. LeBlond Machine Tool Co., Cincinnati, Ohio.

**Air-Operated Work-Holding Devices:** A booklet showing how air-operated chucks and devices of various kinds can be applied to different kinds of machines to save time and labor has been issued by The Logansport Machine Co., Logansport, Ind.

**Rapid-Reading Micrometer:** A new type of rapid-reading micrometer, designed to show the reading in numerals, is described in Catalog No. 5, issued by The Lufkin Rule Co., Saginaw, Michigan. The catalog also contains descriptions of the micrometers, calipers, gauges, scales, squares, bevel protractors, and other tools made by this company. Free upon request.

**Time Saving Machine Equipment:** How machining time can be reduced to the minimum by the use of Wizard chucks, collets and tap holders, turret tool posts, self-centering steadyrests, and other McCrosky equipment is told in a book that is issued by the McCrosky Tool Corporation, Meadville, Penna. Will be sent without charge.

**Finish Irregular Surfaces the Modern Way:** Irregular surfaces in dies, patterns, tools and other parts where the use of a file is difficult and laborious can now be finished quickly and neatly by the use of the Kipp Air Grinder. Catalog and prices upon request. Address Madison-Kipp Corporation, 219 Waubesa St., Madison, Wis.

**Midwest Pin Drive Keyway Cutters** are described and illustrated in a catalog that can be had by addressing Midwest Tool & Mfg. Co., 2362 West Jefferson Ave., Detroit, Michigan.

**Polish at Any Speed:** The Mitchell motor-driven polishing lathe, in which herringbone gears are used to transmit power from the motor shaft to the lathe spindle, can be operated at any desired speed. Bulletin can be obtained by addressing the Mitchell Engineering Co., Springfield, Ohio.

**Compound Spot-Facing Tool:** A spot-facing tool retracting, serrated roughing cutters and fixed finishing cutters in the same tool will break up the scale easily and do accurate work. Write for bulletin to Mummert-Dixon Co., 120 Philadelphia St., Hanover, Penna.

**"The Answer to Your Gear Problems":** Information as to correct methods of cutting and finishing gears will be supplied without charge by The National Tool Co., Cleveland, Ohio. This firm also carries a complete stock of gear shaper cutters and markets the National-Cleveland Spur and Helical Gear Grinding Machine.

**Save Time with Expanding Mandrels:** How expanding mandrels will solve the problem of turning pieces with odd-size holes, and will increase production on duplicate work is told in a folder that will be sent free upon request by W. H. Nicholson & Son, 136 Oregon St., Wilkes-Barre, Pa.

**Ball and Roller Bearing Data Sheets:** A complete set of data sheets showing all the dimensions and loads at given speeds, and giving instructions for mounting precision ball bearing and Hoffmann roller bearings, can be obtained without charge by addressing the Norma-Hoffmann Bearings Corporation, Stamford, Conn.

**How To Grind Cemented Tungsten Carbide:** A booklet which describes and illustrates the correct methods of grinding tungsten carbide tools has been published by the Norton Company, Worcester, Mass. Copy free upon request.

**"O. K." Tool System:** The O. K. System for lathes, planers, shapers, boring mills, and other production machines consists of special forged steel holders with complete sets of tool bits of special design. Particulars can be had by addressing The O. K. Tool Co., Shelton, Conn.

**Die Making Machines:** How dies, templates, gauges, etc., can be sawed out, filed, and lapped easily and accurately on Oliver die making machines is fully described in a bulletin issued by the Oliver Instrument Company, 1430 Maumee Street, Adrian, Mich. Mailed upon request.

**"Fastenings"** is the title of a booklet, issued by the Parker-Kalon Corporation, 192-196 Varick Street, New York, N. Y., in which are included the results of surveys made in fourteen different plants as to the efficiency of fastening methods. Copy free upon request.

**"Most Frequent Mistakes Made in Hardening:"** Users of steel can obtain a wall-chart on which are listed the most common mistakes made in hardening tool steels, results of mistakes as shown on the tools, appearance of fracture, and suggestions for remedying the mistakes, by writing to the Poldi Steel Corporation of America, 247 West 18th Street, New York, N. Y.

**Do Your Bench Work on a Machine:** Bench work that heretofore has been done by hand can now be done quicker, cheaper, and better on the P. & W. Vertical Shaper. Full particulars can be had by addressing Pratt & Whitney Co., Hartford, Conn.

**Tapping Devices, Quick-Change Chucks, Stud-Setting Tools and Bench Tappers:** A catalog describing the various types and kinds of tapping, drilling, and stud-setting devices manufactured by the Proconer Safety Chuck Company, 12 South Clinton Street, Chicago, Ill., can be obtained without charge by addressing this company. The catalog also tells the part that Proconer tools play in obtaining greater accuracy and less tap breakage.

**Engine, Turret, and Gap Lathes** are described in a series of bulletins that have been issued by The Rah-Larmon Co., 2935 Spring Grove Ave., Cincinnati, Ohio.

**Shape or Slot With This Machine:** The Rhodes Convertible Shaper, made by The Rhodes Mfg. Co., Waltham, Mass., can be used for horizontal shaping or vertical slotting. Details upon request.

**Bench Lathe Mounting and Driving Equipment:** Bulletin 120-A, issued by Rivett Lathe and Grinder Corporation, Brighton, Mass., contains complete descriptions and illustrations of modern and conventional countershaft, individual motor drive jackshaft, and speed box motor drive, also benches, cabinets, oil pans, etc. Copy free upon request.

**Fullmore Industrial Clutch:** A multiple disc clutch, made in two types, to run in oil or dry, and which is so built that it can be operated at high speeds, is illustrated and described in a folder that will be sent free by the Rockford Drilling Machine Company, Rockford, Ill.

**Hydraulic Shaper-Planer:** The most modern features are embodied in the design of the Rockford Hy-Draulic Shaper-Planer, which is intended for work that would otherwise go to the small planer or large shaper. Write for folder to Rockford Machine Tool Co., 2414 Kishwaukee Ave., Rockford, Ill.

**Automatic Lubrication:** Individually motor-driven pumps that keep the work flooded with lubricant are described in a booklet that has been published by the Ruthman Machinery Co., Front and Pike Sts., Cincinnati, Ohio.

**Stop Belt Hook Accidents:** Safety Belt Hooks grip the belt firmly, keep it in perfect alignment, and have no projecting points to injure the workmen. Write for information. Safety Belt-Lacer Co., Toledo, Ohio.

**Electric Tools:** The complete line of "Ideal" electric drills, screwdrivers, nut setters, and grinders of various types is described and illustrated in Catalog No. 30, issued by The Schauer Machine Co., 907 Broadway, Cincinnati, Ohio. Copy free upon request.

**Full Automatic Hobbing:** Small pinions, gears, ratchet wheels, and similar parts can be hobbled economically on a full automatic hobber with magazine attachment. For full details write the George Scherr Company, 142 Liberty St., New York, N. Y.

**Stamp Your Name on Your Product:** Full information as to the steel roller dies made by The Schwerdtle Stamp Co., 10 Cannon Street, Bridgeport, Conn., can be obtained by writing this firm.



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Users say, on wheels where quick action is necessary you can't beat the Desmond-Huntington Dresser.



It sharpens a dull or glazed wheel faster than any other method. Try it!

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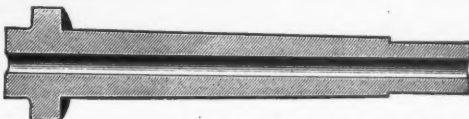
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Your requirements in any material—carbon, alloy and stainless steel—for spindles, rams, clutch shafts, piston rods and similar parts are produced by specialists here. Better quality, better price and better delivery have made American for years the headquarters of leading users of these kinds of parts. *Send blueprints for complete data and prices.*

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**"Viking" Lathe:** A lathe of the most modern design, with features that make it applicable for a great variety of work, is described in a folder that will be sent free upon application to The Sebastian Lathe Co., 1 Culvert Street, Cincinnati, Ohio.

**Economies in Material Handling:** A volume of facts about planned load handling, with actual examples of economies in time, material, and labor costs that have been effected with Shepard electric hoists will be sent free upon request to Shepard-Niles Crane & Hoist Corp., 424 Schuyler Avenue, Montour Falls, N. Y.

**Rapid Drill Jigs:** How time can be saved and drilling operations made easier by the use of a quick-acting drill jig is told in a booklet that is issued free by the Slevak Tool & Die Co., 10230 Woodward Ave., Detroit, Michigan.

**Simonds Files:** A useful book on files showing the various styles made, their uses, cross-section, and cuts, and containing a number of reference tables and other information useful in a machine shop can be had by addressing Advertising Dept., Simonds Saw & Steel Co., 470 Main Street, Fitchburg, Mass.

**The Most Efficient Speed for the operation of special production units, power conveyors, and other machinery by the use of the WBS Speed Reducer and how it can be obtained is told in a bulletin that will be mailed free by Winfield H. Smith, Inc., 30 Eaton St., Springfield, N. Y.**

**A Snyder Tool Set-Up, consisting of a Snyder ball-bearing multiple head, bushing plate, and work holding fixture, will convert a single spindle drill into a multiple drill at small cost. Particulars upon request. Address Snyder Tool & Eng. Co., 3400 E. Lafayette Ave., Detroit, Michigan.**

**Speed and Accuracy in Straightening:** The Springfield Straightening Press is an ideal tool for use in straightening any length or size of rough or finished work. Send for illustrated folder. Address The Springfield Machine Tool Co., 630 West Southern Avenue., Springfield, Ohio.

**Stackbins Save Space:** Bins which may be used as individual containers, as tote-boxes, or "nested" to form stock-room sections are described in an illustrated circular published by the Stackbin Corporation, Pearl and Rice Streets, Providence, R. I.

**Accurate Gages Speed Production:** The complete line of snap, plug, ring, pin, dial indicator, and special gages made by the Standard Gage Co., Inc., Foughkeepsie, N. Y., is described and illustrated in Catalog No. 4, which can be had without charge by addressing this firm. Johansson gage block sets and accessories are also listed in this book.

**Machinists' Tools and Gages:** Catalog No. 24, issued by the L. S. Starrett Co., Athol, Mass., describes and illustrates the complete assortment of machinists' fine tools and gages made by this firm. Copy free upon request.

**Rigidmilling Principles and Practice:** A book that shows how the Rigidmil can be adapted to various kinds of usual and unusual milling operations, and which describes in detail the work that can be handled by this machine has been issued by the Sundstrand Machine Tool Co., Rockford, Ill. Copy free upon request.

**Cutting and Grinding Facts:** A discussion of cutting oils and lubricants, together with descriptions and illustrations of various kinds of jobs upon which cutting oils are used, is contained in a booklet that is issued by the Sun Oil Company, Finance Building, Pittsburgh, Pa. Free upon request.

**Simplify Your Tooling Problem** by using Swartz standardized jigs and fixtures. A step forward in production methods. Ask for Catalog 131-B. Swartz Tool Products Co., Detroit, Mich.

**Snap, Plug, Ring, and Thread Gages:** The complete line of precision gages made by The Taft-Peirce Manufacturing Co., 32 Mechanic Ave., Woonsocket, R. I., is described in a folder which can be obtained, free, by addressing this company.

**Penetrating Oil for High-Speed Equipment:** Three-In-One Oil, blended scientifically from animal, mineral

and vegetable oils, will penetrate the tightest bearings and lubricate high speed units perfectly. Full information can be had by writing Three-In-One Oil Co., Dept. 96, 130 William St., New York, N. Y.

**A Simplified and Improved Drive Control for Machinery:** Two distinct types of plate clutches that have proved successful highly in the driving mechanism of machine tools are described and illustrated in a bulletin that will be sent free by the Twin Disc Clutch Company, Racine, Wis.

**Powerful, Easy-Acting Chain Hoists** of the most modern design are described and illustrated in a booklet that is issued by the Union Manufacturing Co., 296 Church St., New Britain, Conn. Copy free upon request.

**Change drilling speeds instantly without stopping the machine or touching a belt.** This can be done with the Victor Super-Drill, made by U. S. Automatic Box Machinery Co., Newtonville, Boston, Mass. Bulletin free upon request.

**Multiple Drilling with a Single-Spindle Drill:** Methods by which multiple drilling may be done on a single-spindle drill, using multiple spindle drill heads, are discussed in a bulletin that is issued by The United States Drill Head Co., 1954 Riverside Drive, Cincinnati.

**Electrically-Driven Portable Tools:** The "U. S." line of electric drills, die grinders, electric screw drivers, surface grinders, tool post grinders, and bench and floor grinders is described in Catalog No. 29, which has been published by The United States Electrical Tool Co., 2471 W. Sixth St., Cincinnati, Ohio.

**Dress True Radii on Grinding Wheels:** Hand fitting on either convex or concave radii can be eliminated by grinding the radii with a wheel that has been accurately dressed with a Universal Radius Dresser. Write Universal Tool & Machine Co., 14 St. Louis Avenue, Dayton, Ohio, for particulars.

**How to Measure Threads with Wires:** Circular W26, issued by The Van Keuren Co., Watertown, Mass., tells how to obtain the correct thread pitch diameter with a micrometer and wires. Copy free upon request.

**Tool Chests for Machinists and Toolmakers:** The complete line of fine tool chests for machinists and toolmakers made by J. M. Waterston, 420 Woodward Ave., Detroit, Mich., is described in Catalog No. 25. Ask for it.

**Wappat "Red Streak" Electric Tools** including hand-saws, drills, grinders, planes, and other tools, are described and illustrated in a catalog which can be obtained free by writing Wappat, Incorporated, 7523 Mead St., Pittsburgh, Penna.

**Wetmore Adjustable Reamers:** The exclusive features of the Wetmore Adjustable Shell Reamer are discussed in Catalog No. 29, issued by the Wetmore Reamer Co., 62 27th St., Milwaukee, Wis. Copy free upon request.

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**Change Punches Without Removing Die:** The user of Hercules Interchangeable Punches and Retainers can change punches without removing the die from the press. Information that will help to lower die-building costs, reduce lost time for repairs, and increase press production can be had by addressing Whitman & Barnes, Inc., Detroit, Michigan.

**Whiton Steel Body Lathe Chucks:** The various types and sizes of steel body chucks for lathes that are made by the D. E. Whiton Machine Co., New London, Conn., are described and illustrated in a booklet that will be sent free upon application to this firm.

**Wrenches For Every Use:** "Guaranteed Against Breakage" tappet wrenches, pipe and fitting tongs, offset wrenches, and wrenches for all other uses are described and illustrated in a series of folders which can be obtained without charge by addressing J. H. Williams & Co., Buffalo, N. Y.

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FOR ILLINOIS FILING MACHINES

GROBET SWISS FILES are precision files of high cutting speed, unexcelled for durability. They are required by every manufacturing line where accuracy in filing is essential.

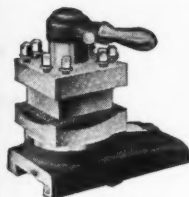
Grobet Swiss Files are made in nine numbers of cuts: Nos. 00, 0, 1, 2, 3, 4, 5, 6, 8.

Ask for catalog K showing 3,500 different styles. Specialties: Files for filing machines—Illinois, Hartford, Oliver, Cochrane, La Porte, Thiel, Excel, etc.

GROBET FILE CORP. of America

3 Park Place, New York City

## STANDARDIZED LATHE TURRETS



STYLE "G"

Square head, for carrying four ordinary lathe tools.

8 Styles

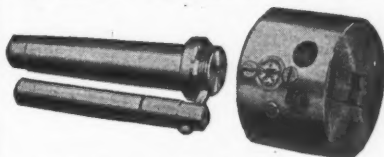
12 Sizes

For any make or size of Lathe, old or new.

Ask for Circular No. 18

**FAY & SCOTT**  
DEXTER, MAINE

## FLYNN MICROMETER OFFSET BORING HEADS



FOR ECONOMY IN PRECISION BORING

The least overhang of any head on the market, yielding utmost rigidity and maximum table travel. Made in a full range of sizes to fit all standard spindles and arbors.

Send for Circular and Price List

**WATERSTON'S**  
420 Woodward Ave. Detroit, Mich.



## Nicholson Expanding Mandrels

Convenient setting up equipment that may save its cost setting up a single job. Sizes to fit all bores from  $\frac{1}{2}$ " to 7" diameter inclusive; No. 4 shown, fits bores from 2" to  $2\frac{1}{2}$ ".

Send for details and prices.

**W. H. NICHOLSON & COMPANY**  
136 OREGON STREET WILKES-BARRE, PA.

# Hotel Hollenden

Theo. DeWitt, Vice Pres. and Gen. Mgr

## CLEVELAND

**Announces**

**Revised Rates!**

Following the trend of the times, Cleveland's leading hotel announces the following changes in room rates  
---effective immediately



ALL FORMER

**\$3.50** ROOMS **\$3.00**  
NOW

**\$4.00** ROOMS **\$3.50**  
NOW

**\$4.50** ROOMS **\$4.00**  
NOW

Four-Station selective Radio now being installed in every Hotel Hollenden room.



**Only a handkerchief...**

**B**UT it was no joking matter to the bride. Someone had stepped on her "going away" handkerchief. The rare little bit of handed-down lace was crumpled and soiled. And it had to be washed with infinite care. Could we? We could and did.

We rather pride ourselves on our ability to take care of our guests. You'll find it reflected in larger rooms...larger closets...in every appointment which a hotel worthy of the name provides. But where you'll be sure to notice a spirit of *extra* service is in all the little things, where United Hotel employees are taught to take the time to do well!

*You can always be sure of extra service at all the 25 United Hotels*



# Hotel PENNSYLVANIA

39th & CHESTNUT ST. - PHILADELPHIA

ROOM *with* BATH \$3.00

*Situated at the  
terminns of the  
main Southern,  
Western and  
Eastern  
Highways*



# The <sup>When in</sup> K BOSTON Kenmore

GEORGIAN  
HOTEL  
COMPANY  
*Proprietors*

400 Rooms . . .

. . . 400 Baths

Tub—Shower—Shampoo Spray  
Coffee Shop and Main Dining Room

**PRIVATE PARKING**



An Entire Block on the Boardwalk,  
between New Jersey Ave. and St. Charles Place.

**AMERICAN and EUROPEAN PLANS**

## SUN DECK

*The largest and longest on the Boardwalk.  
Occupying an entire city block directly facing  
the ocean. The foremost point at sea, in*

Sea Water Baths  
Concerts Daily

**ATLANTIC CITY**



By GEO. ALEXANDER MANN

### Meow

"What are yuh writin'?"  
 "A joke," said Miss Dove,  
 "Oh," said Lizzie,  
 "Give him my love."

Maw says when a jane blahs that a man is all the world to her, the chances are she ain't seen much o' the world.

One o' the best we've heard recently is the one about the billy goat. He said, "Now, this is what I call food for reflection," an' proceeded to eat the mirror.

### Huh?—Can Yuh?

Say, can you imagine  
 One in misery more  
 Than a kleptomaniac  
 In a piano store?

### There's An Ask

What is it, Mel, that makes heatin' the bank such a big part of its overhead? Is it the frozen assets or the frosty faces?

### Alas

The poor chap's dead,  
 Said Doctor Supp,  
 He had St. Vitus  
 An' the jig is up.

### Sez Mandy

"Ah wants fire insurance,  
 Foh mah man, Sam Meeks,  
 He's been fired fo' times  
 In de las' two weeks."

Home brews lead to home bruises.

Laugh at yourself an' you've conquered life.

### Then It Happened

Maw laid paw flat,  
 When she saw him use  
 His Xmas tie  
 To shine his shoes.

The trouble with the surgeons is they're always feelin' too operatic.

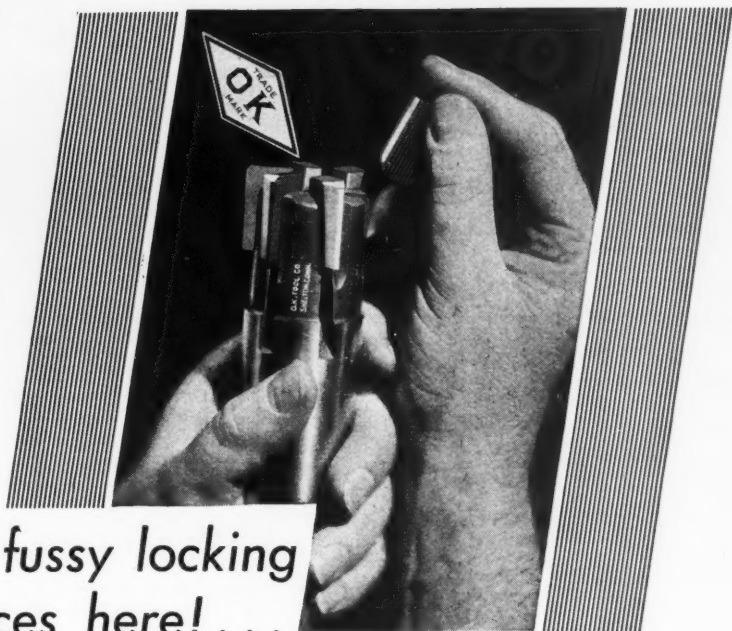
There may be such a thing as cheap politics, but you can't make the taxpayer believe it.

### Some Coaxer

He asked her to marry him  
 An' when "no" was her retort,  
 With a cheery smile he said,  
 "Aw come on, be a 'support'."

When we don't need the money  
 watch the banks get liberal.





## No fussy locking devices here! . . .

- There are only two essential parts—the cutters and the holder. You never have to fuss with "O.K." inserted blade tools—there are no pins, wedges or other locking devices. The "O.K." idea is the original serrated tooth system . . . blades locate themselves . . . lock themselves and stay put. Notice the wedge-shaped cutters.
- "O.K." cutting blades are drop forged, too . . . and cheaper than solid tools in most cases.
- Other exclusive "O.K." features are described in our new booklet—"CUTTING COSTS WITH CUTTING TOOLS" . . . free on request.

**THE O.K. TOOL COMPANY, INC.**  
SHELTON . . . . . CONNECTICUT

**O.K.**

System of In-  
serted Blade  
Tools for the  
Metal Cutting  
Industries

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A good one for your Driller,  
Miller, Shaper or Planer.

# **VISE**

Jaws 6", 9" and 12" Long  
V-Jaws, extra, for All



Fig. 2. Without  
Attachments

With and Without  
Jig Attachments

Any vise will pay.  
More time is consum-  
ed in catching work  
than drilling it.

Send for Circulars

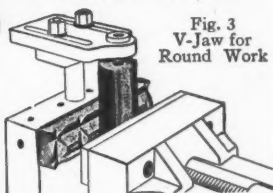


Fig. 3  
V-Jaw for  
Round Work

**THE GRAHAM MFG. CO.,** 69 Willard Ave.  
Providence, R. I.

## **LUFKIN** **TELESCOPING GAGES**



Both telescoping  
plungers move in the  
head so the handle  
can always be lo-  
cated in the center of  
the tool. This is an  
exclusive feature  
and one which per-  
mits that perfect bal-  
ance and feel so es-  
sential to accuracy.

SEND FOR CATALOG

**THE LUFKIN RULE CO.**

PRECISION TOOL DIVISION  
SAGINAW, MICHIGAN

Come to  
Head-  
quarters  
for

**Grooved  
(Cast Iron)  
Pulleys**



All Size Holes

Pulley Diam. inches	Size of Holes inches
2 1/2	3/8 1/2 5/8
3	1/2 3/4 1
4L	3/4 1 1 1/4
4	1 1 1/4 1 1/2
5	1 1/2 1 3/4 2
6	1 3/4 2 2 1/4
8	2 2 1/4 2 3/4 3
10	2 3/4 3 3 1/4 4
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Special Holes Bored

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By New York City

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Speed  
Reducers  
V-Belt Drives

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1408 W. Colfax Denver, Colorado

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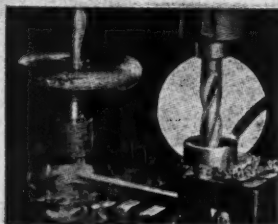
For all small holes (open or blind), races, bush-  
ings, etc., and most any place hard-to-get-at; as  
on dies, tools, gears, etc. Hundreds of sizes,  
shapes, any shank.

**CHICAGO WHEEL & MFG. CO.**

406 East Woodbridge St.  
DETROIT

110 South Aberdeen St.  
CHICAGO





## "SHOWDOWN" ON DRILLS...

All the cards were on the table—face up. An automotive manufacturer wanted to find the most economical drill to use on five of the most difficult jobs in the plant. Five leading makes of drills were tested on the basis of cost per hole drilled by each.

Conducted by the plant superintendent solely for his own guidance in purchasing drills, the test was impartial in every respect. Stock drills were run on the same press under automatic feed, and with one standard lubricant. Representatives of various drill manufacturers were present to watch the test and were permitted to offer suggestions.

When the tests were completed, the average holes per grind were computed for each drill. The performance of the best drill, a Cle-Forge, was rated at 100%. Other drills were rated in comparative percentages to that of the best.

The results on the five jobs:

Cleveland CLE-FORGE High

Speed Drills	96.7%
Drill—A	41.6%
Drill—B	66.4%
Drill—C	75.6%
Drill—D	66.7%

The Cle-Forge percentage was 29.9 points better than the average of all other drills—20.9 points better than the second best—33.1 points better than the poorest. On one pregs alone, the annual savings in drill cost effected by Cle-Forge Drills is \$93.04 over the

second best drill, and \$176.70 over the poorest drill.

Many other conclusive figures were brought out in this test. . . . figures which will interest every buyer of drills who would like to reduce drill costs. Copies of the detailed report will be mailed on request, together with complete forms for conducting a similar test in your own plant. There is no obligation of any kind. The coupon at the right is for your convenience.

THE CLEVELAND TWIST DRILL COMPANY  
1740 E. 40TH ST. CLEVELAND

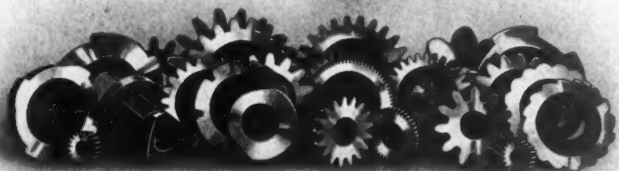
Send us a copy of Report No. 83 and "Cost-per-Hole" Test Forms. We're not obligated in any way.

Name \_\_\_\_\_

Company Name \_\_\_\_\_

**Address** \_\_\_\_\_





## For More Than Gears

THE cost-saving advantages of the generating principle as applied on the Fellows Gear Shaper has many possibilities.

Not only in the sense that any part can be more accurately produced by generating than by forming, but production of accurate work is also greater.

Each and every Fellows Gear Shaper Cutter is an original tool with the tooth curves generated after hardening. While accuracy is its prime virtue, its range of application is certainly worthy of your consideration. A few of the many possible applications of this accurate generating tool are presented in booklet No. 10. Write for your copy.

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Head Office and Works: 78 RIVER STREET, SPRINGFIELD, VT.

Branch Office: 616 FISHER BUILDING, DETROIT, MICH.

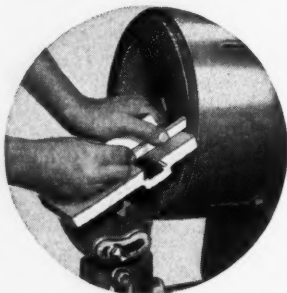
*With Original Fellows Gear Shaper Cutters Acceptable Work Is Assured*



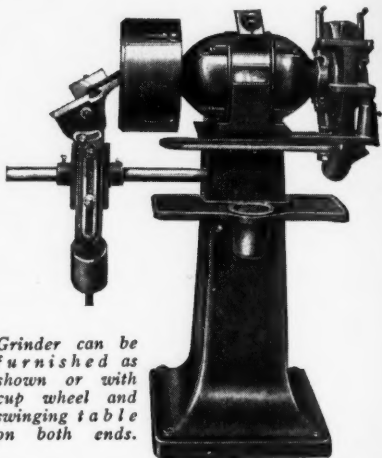
# NEW!

**N**OW your tungsten and carbide tools can be sharpened to a perfect edge automatically—and without the removal of a bit more metal than is absolutely necessary! The new U. S. Tungsten Carbide Tool Grinder is designed especially for this purpose. And it pays for itself many times through its big new advantages:

- (1) Your high speed tools last longer—a real item in view of their higher cost.
- (2) Fewer sharpenings are required.
- (3) Less time is necessary for sharpening.
- (4) The perfect edge prevents chattering and breaking away.
- (5) Better finished results naturally follow with better sharpened tools.



Protractor markings on tool rest enable adjustable table and sliding guide to hold tool at any angle, and securely, against the cup wheel.



Grinder can be furnished as shown or with cup wheel and swinging table on both ends.

## Tungsten Carbide Tool Grinder

This new grinder is equally as sturdy and dependable as all the others in the broad U. S. line—"The Good Mechanic's Choice" since 1897; SKF Ball Bearings. Heavy, one-piece, nickel alloy steel spindle. Powerful 2 H.P. motor of 1,750 r.p.m. furnished in any standard voltage, A.C. or D.C. Push button control. Boiler plate wheel guards, adjustable to wheel wear, etc.

**FREE**—Send your name and address in the margin of this ad for full particulars and prices. Or ask your distributor today. New catalog of complete U. S. line gladly furnished on request.

### THE UNITED STATES ELECTRICAL TOOL CO.

Oldest Builders of Electric Drills, Grinders and Buffers in the World

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Dept. I

CINCINNATI, OHIO

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